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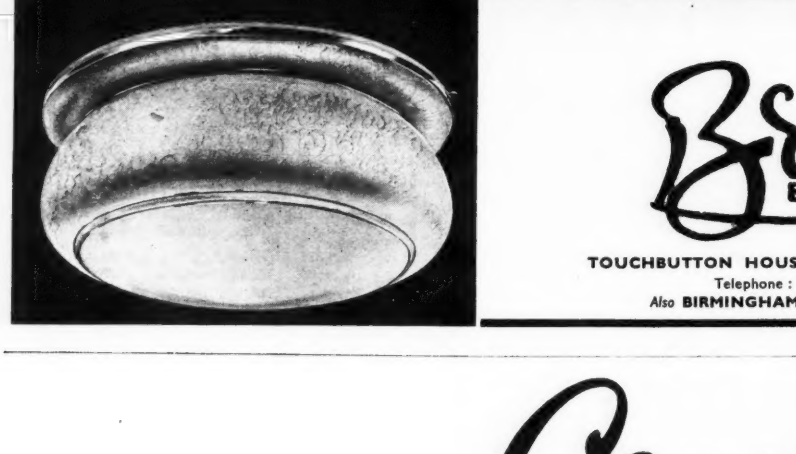

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THE
ELECTRICAL REVIEW

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Vol. CXXVI. No. 3254 APRIL 5, 1940 Price SIXPENCE

Loudness and the Individual

The Quest for Quieter Transformers

NOISE is unwanted sound. It is unwanted by the designer of plant because it implies losses, and by the general public for the discomfort it causes. The second is by far the more important and becomes of especial urgency in the case of transformers, since these tend increasingly to be situated at the centre of the load in residential areas. Their average size also becomes greater, and rated kVA is a material factor in the intensity of the sound emitted.

One important feature of the present situation is that transformers are particularly suited to outdoor installation, permitting considerable saving in building costs, but if they provide cause for complaint, obstacles are likely to be raised to this practice. As one outstanding advantage of AC distribution is flexibility due to the possibility of stepping the voltage up or down, noise prevention is eminently a matter for co-operative investigation, which was the reason for the committee set up in 1934 by the E.R.A. under the chairmanship of Professor R. O. Kapp. Definite contributions towards knowledge of engineering noise have also been made by Messrs. B. G. Churcher and A. J. King in their I.E.E. papers during the past ten years, the fourth of which was presented last week and is reported in this issue.

Measurement of Noise

Before considering means for reducing noise to tolerable proportions, one should be able to determine its value both as to quality and quantity. The qualitative aspect is not so important in the case of transformers as of some kinds of machinery in which the sound varies in pitch. Nevertheless, there remains the difficulty that the annoyance occasioned by transformer hum depends so much upon the manner in which it is heard, and this differs widely among individuals. Since transformer noise is more or less steady, it lends itself well to quantitative estimate, and the impression of loudness received by a representative group of listeners compared with a given reference tone provides the best practicable method of measurement. This was the basis of the "phon," the unit adopted in 1936 by the British Standards Institution.

It is axiomatic that trouble should, if possible, be eliminated at its source, but, as the authors and those who took part in the discussion showed, there is very little to be gained by altering the design of transformers within commercial limits. The main cause of transformer noise, as Dr. Swaffield has recently shown, is magneto-striction, *i.e.*, vibration due to change in length and area of the core that occur together under the influence of a magnetic field. The old idea that tightening core bolts and clamping could effect appreciable improvement has been shown to be fallacious. Attempts to limit the effects of magneto-striction by reducing flux density, however, yield only slight relief at a disproportionately heavy cost.

Methods Adopted at Fulham

A good illustration of the material value of these studies is afforded by the 75,000-kVA transformers at Fulham power station, which were put into commission some three-and-a-half years ago. On account of the proximity of residential property, all means were taken to avoid cause for offence. The transformers were run at a low flux density and the tanks rested on rubber pads. Each transformer was housed in a brick chamber without openings. It may reasonably be supposed that the last precaution was much the most effective.

Efforts to obtain a silent transformer are likely to be fruitless. Attenuation of unavoidable sound offers the most promising line of attack, so the authors put forward, as a less costly alternative to bricking-in where conditions would otherwise make that necessary, a scheme of barriers within a larger tank which would absorb both radial and longitudinal sound waves. Almost every case has to be considered on its merits, however, even apart from the dominant consideration of the background level of sound. Distance and structure of the surrounding houses are principal factors, but even here resonance may play curious tricks.

The first need appears to be to secure a standard attenuation acceptable in ordinary conditions and then to provide means to predict with certainty the additional attenuation required to meet the peculiarities of local circumstances. In addition, the establishment of noise levels regarded as tolerable would be helpful, if only because (since psychology enters into the equation) objection to constituted standards would appear unreasonable. It may be

fairly claimed, we believe, that research on present lines augurs well for an economical solution of the noise problem without departing from the well-established principles of transformer design.

"Truce" and Public

WHATEVER may be the merits of the "truce" to certain activities which has been arranged between electricity supply and gas interests we feel that the matter has been given far too much publicity. Such an arrangement, if necessary, should have been made privately by the parties concerned—it is no matter for the general public. And yet the Press of the whole country has published the news in a form suggesting that all competition between the two industries is to cease for the "duration." Such a knowledgeable journal as *Engineering* reports the matter and concludes "Verily, war makes some strange allies!" After all the truce is designed merely to eliminate all suggestions of a damaging or disparaging nature in propaganda and canvassing and it is recommended that there should be closer co-operation between representatives of the two industries engaged in sales and publicity work to achieve this object. The *Engineering* report mentions closer co-operation between these staffs, without any qualification. We maintain again that if the public gets the idea that the *status quo ante bellum* is to be maintained it is not the gas industry which will be the loser.

Winning the War

IT is possible to disparage without mentioning names. There is appearing in local newspapers all over the country an article which in each case purports to be an interview with the manager of the local gas undertaking. This shows how gas "besides supplying clean labour-saving fuel to millions of homes and hundreds of industries also makes available many vital war materials." It is a good story well told. We would like to see a good electrical story spread as widely; one, for instance, mentioning the fact that electricity by using much lower grades of coal than some other industries, releases hundreds of thousands of tons of higher grades for export and at the same time achieves a remarkable economy of resources. No other industries should be specifically mentioned.

Export Trade

WE are receiving many indications of the interest aroused by our special export issue of March 15th and it is evident that there are many people in the Empire and foreign countries who are anxious to do electrical business with the United Kingdom. The British Commercial Agent in Palestine, a small but promising market, says that with the elimination of Central European sources of supply for electrical fittings, accessories and equipment and owing to the desirability of buying in Empire and sterling bloc countries with a view to conserving exchange, more interest is now being displayed in United Kingdom electrical manufactures than at any time in recent years and the present juncture may be looked upon as favourable for an expansion of United Kingdom sales in Palestine.

Prices and Materials

AN encouraging statement regarding the value of business in hand was made at last week's annual meeting of Associated Electrical Industries, Ltd., by the chairman, Sir Felix Pole. He gave a figure of £19 millions for the group, and referred particularly to export business. A large power station contract from Turkey (£1,500,000) was mentioned, and Sir Felix assured the shareholders that the organisation was doing everything possible to strengthen its position in overseas markets. One direction in which Government assistance was needed was stressed: it was difficult for manufacturers to quote firm prices for large contracts with distant delivery dates in view of the rising costs of labour and materials, and it was felt that the Government should help in dealing with this problem. The matter is one which was referred to some time ago by Mr. Oliver Stanley while he was President of the Board of Trade. He informed the House of Commons on December 7th that the Government was "considering the possibility in appropriate cases of having some scheme which would make it possible for firms to make firm tenders and to obviate the loss of orders." Tenders for large electrical plant are surely "appropriate cases." Again, in its statement of policy the Export Council promised to examine "a number of points bearing upon the essentially practical problems of firm delivery dates and prices." Manufacturers are naturally anxious to see early action in this matter. At the Lancashire Dynamo & Crypto meeting on Monday the chairman, Mr. A. E. L. Chorlton, M.P., mentioned the activity of his company in the export sphere, but complained of difficulty in securing sufficient material for export orders. The ensuring of adequate supplies is one of the principal functions of the Export Groups, and no doubt the matter is well in hand.

Arcs in Fluids

RESEARCH into the reason for the more rapid extinction of an arc when the fluid in which the break occurs is in motion has just been concluded by Dr. Slepian and Dr. T. E. Browne at Pittsburgh. The results indicate that the likelihood of an arc restriking after interruption of a circuit depends upon the amount of gas present in the bubbles surrounding the arc immediately before current zero, which is the critical instant. By the use of a special method of photography, the investigators have found that the bubbles expand and contract at a high frequency which bears no apparent relation to the electrical frequency but which depends upon the speed of the fluid flow past the electrodes, the velocity reaching 200 ft. per sec. Water was used in the investigations with a view to obtaining clearer photographs, but there seems no reason to doubt that similar results would have been obtained with oil. It will be interesting to see whether these investigations will appreciably influence the design of oil-immersed circuit breakers.

Prices and Grouses

WHILE all commodities are going up in price, some to an unconscionable extent, the public (or at least that part of it which spends its spare time writing to the papers) seems to direct most of its attacks towards electricity supply authorities. In few instances (and usually in special circumstances) has the price of electricity been raised by more than 15 per cent., and yet this has caused far greater outcry than jumps of 50 per cent. or more in other directions. Possibly this is due to the fact that a public utility is a recognisable entity while the prices of other commodities are controlled by nebulous forces far away from the point of supply. Or perhaps it is political, as Sir Robert Renwick suggested at the annual meeting of the Richmond (Surrey) E.L. & P. Co. last week. For years the electricity supply industry has been fair game for politicians, local and national, of all parties, who think that political control would raise efficiency and lower prices to an amazing degree. Perhaps company undertakings are more frequently the target than are local authorities, as Sir Robert suggested, but none escapes the slings and arrows of outrageous electro-Utopians.

An Engineer Administrator

BY the death of Mr. W. B. Woodhouse the electrical world has lost one of its leading figures at a time of greatest need. He presented a notable example of the engineer of the highest qualifications who was equally well equipped for managerial duties. His activity in advancing the technical aspects of his profession was balanced by his concern for its sound commercial and financial development. As a representative of the electrical interest on many public bodies he showed an ability to work with other interests in furthering a common aim while at the same time supporting with proper firmness the electrical point of view.

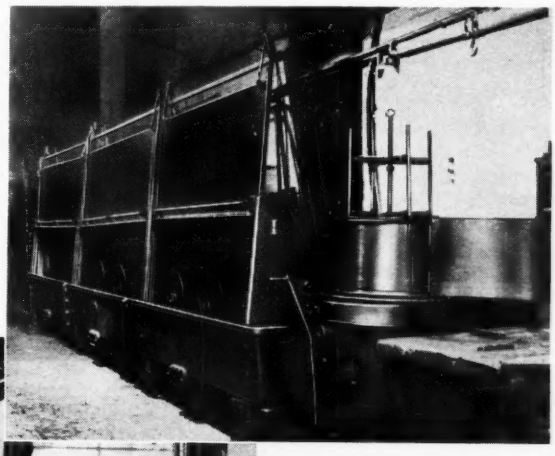
MODERN WIRE DRAWING

Processes at a Wakefield Works

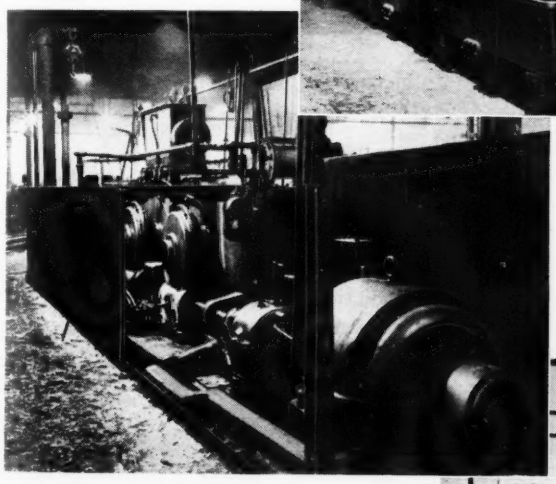
THERE is dual interest for the electrical visitor to the works at Wakefield of the Spencer Wire Co., Ltd. Modernisation work has been in progress for some time and there are some particularly well adapted drives and other electrical applications, while on the copper side of the business (both copper and steel wires are products of the company) the electrical industry is served in many ways with conductors for all types of equipment. As the electrical applications to both the copper and steel sides are similar in many respects, we propose to devote our attention to the copper wire, strip and bar production.

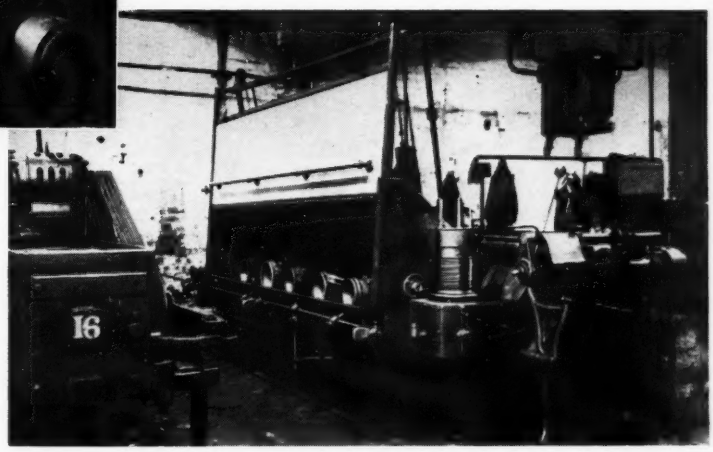
The principle type of raw material used is hot rolled copper rod ranging in diameter from $\frac{1}{4}$ in. to $1\frac{1}{4}$ in. in pieces weighing about 240 lb. Heavier sections are either extruded or hot rolled and range in sizes up to $2\frac{1}{2}$ in. square or round and sections up to 5 in. × $\frac{3}{4}$ in. The rod having been hot rolled, it is necessary to remove from its surface the oxidisation scale, and this is done by pickling it in acid tanks.

A recent visit which we paid to the works has left us with the impression of the copper-wire drawing processes in three main groups, and we propose to treat our description in this way, but actually there is a good deal of overlapping between the groups.



This nine-die tandem (showing the draw pulleys and dies) will reduce rod to .052 wire





Above: This six-die tandem has a 150-HP motor drive. Right: A 22-die equipment representative of machines in the third drawing group

In the first there are a number of machines which are usually fed with rod direct from the pickling tanks and, roughly, the rod may be reduced to any of a large number of sizes down to, say, 0.052 in. A nine-die tandem machine will reduce rod to sizes between the limits of $\frac{1}{4}$ in. and 0.052 in. The dies are arranged along one side of the machine, each being served with its own draw pulley. There are two drives, one for the draw pulleys and one for the finishing block. The draw-pulley motor is of 150 HP and drives through reduction gearing the heavy shaft from which a bevel subsidiary drive is taken to each draw pulley. The motor speed is 960 RPM and the draw pulley speeds vary from 50 to 250 RPM (finishing block). The other motor drives the finishing block and is of 10 HP. It runs at 720 RPM.

A six-die machine in this group will reduce the $\frac{1}{4}$-in. rod to 0.064 in., and although from the actual drawing point of view it is similar to the nine-die machine, the transmission is different in that from the main shaft the subsidiary drives to the draw pulleys are via worm gears. Further, there is no separate motor for the finishing block. The motor is of 150 HP and the overall speed ratio from motor spindle to draw pulley shaft is about the same as that of the nine-die machine.

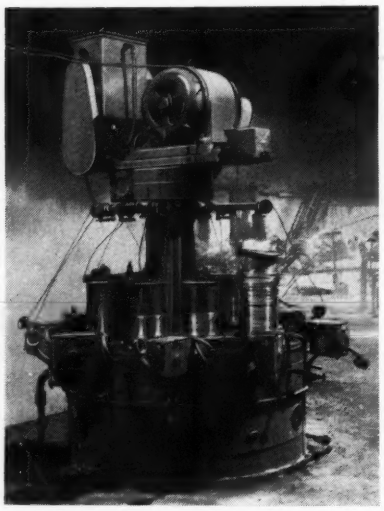
In the second process group are machines which, in the main, deal with the products of the machines in the first group. First in this group comes a fifteen-die machine with two rows of dies, seven in each row, and a final die immediately before the finishing block. Wire speed variations for the different dies are catered for by cone-shaped drawing pulleys. This machine has a wide range of duties between and including the reduction limits of 0.093 to 0.036/0.020 and 0.064 to 0.020/0.0124. The main transmission is by V-belt from a 60-HP 960-RPM motor.

A nine-die machine is one of a number of similar equipments in this secondary group. It will reduce from 0.093 to 0.044/0.028 and is driven by a 50-HP, 960-RPM motor. Transmission is first via a V-belt to a clutch pulley direct on to the shaft and then, in turn, through a chain of gears and bevels to the vertical conical blocks. The block speed is 600 RPM. The cones are stepped to allow for increases in the length of wire progressively during drawing.

For still finer work machines in the third group may be fed either from the first or second groups, according to wire size requirements. A 22-die equipment is representative of this group and it will reduce from 0.080 to 0.018/0.0076. It is similar to the machines of the second group but of lighter construction and has greater

speed. A 30-HP motor transmits first via V-belts to a central shaft and then by internal V-belts to other shafts. Most of the wire is drawn direct on to steel rolls arranged progressively for increasing wire speeds up to about 4,000 ft. per minute.

Although our object is to devote attention mainly to the copper works in this article, some special drawing machines which we saw in the steel-wire works are worthy of note. In each of these the blocks are arranged in a circle on the cylindrical base of the machine. The equipment is self-contained with its 10-HP, 1,000-RPM motor at the top. Transmission is first by V-belt to a cross-shaft, and then by a worm gear to a vertical central shaft from which the blocks are driven through a large spur and pinions. There is a friction clutch on each block and the finishing-block speed is about 250/300 RPM.



In special self-contained drawing machines in the steel-wire works the blocks are arranged in a circle on the cylindrical base of the machine

A specially equipped tinning shop deals with wire which is required to be tinned. A machine for wrapping protective covering round coils of wire ready for dispatch is most ingenious. The coil of wire is held vertically and revolved slowly by three rollers about its periphery. Interlinked with the coil of wire at the bottom is a circular reel guide around which the reel of canvas travels quickly and unwinds itself on to the coil of wire. One small motor serves both operations. Butt welders are employed for connecting lengths of wire to permit continuous operation of the drawing machines. Stationary welders are supplied at 230 V AC, the voltage being transformed down on the welder to about 6 V. Larger welders deal with wire down to 5/16th in. and smaller ones with wire down to 0.0124.

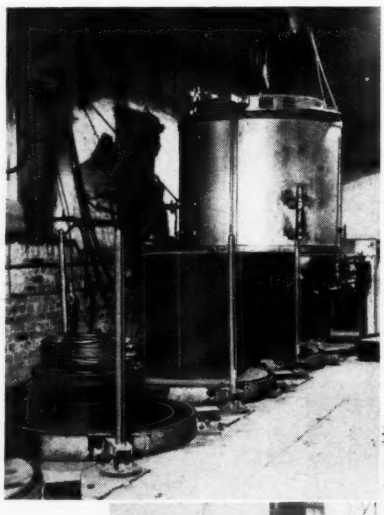
There are several small portable welders which are plugged in at socket points around the works. One of these is a 5-kVA equipment supplied at 230 V, single-phase, and it welds at 2½ V. It has six tappings from a built-in transformer to give various heat requirements for different sizes of wire. When the copper melts the two electrodes are forced together under spring influence and after the requisite movement of the electrodes a trigger operates a contact in the electrode circuit, thus cutting off the supply at the joint. This contact is made in the first place by a push-button on the welder.

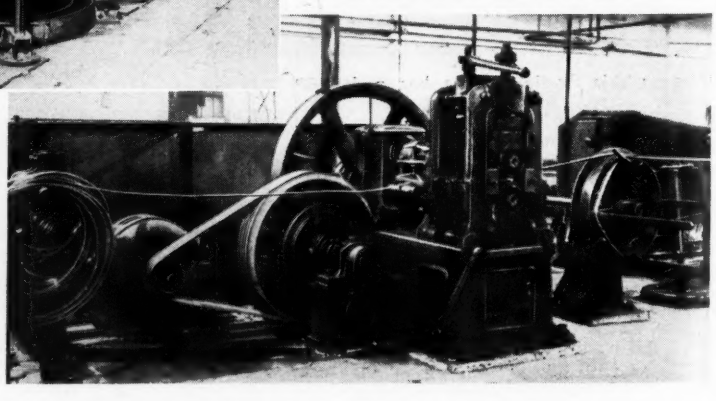
For the supply of overhead stranded conductors in copper, steel-cored copper and copper-cored steel, there is a well-equipped stranding shop. An outstanding machine is a 19-bobbin strander which will build conductors up to 37/.162. The machine is arranged in two sections and is used to produce seven-strand conductors on either section. When the machine is run as a complete unit conductors of up to 37 strands can be constructed by passing them through the machine a second time. Each section is driven separately by its 15-HP, 1,000-RPM motor, even when the two sections are run together as a complete machine, one motor running clockwise and the other counter-clockwise. When the strander is used to produce 37 strands, one motor is used and both sections revolve in the same direction, the necessary change of direction being effected by means of a change-wheel in the gearing. From each motor the drive is first by spur and pinion on to the line shaft, from which another spur and pinion transmits on to the strander shaft.

The production of copper strip is another important function of the works, and the first stage in the processes is flattening the rod through rolls similar to those used for the hot rolling of bars and plates. One of the larger flattening machines is driven by a 45-HP, 1,000-RPM motor which transmits first through V-belt on to a friction plate clutch and thence through double helicals on to a gear box which operates the two heavy rolls through which the rod passes. The rolls are 12 in. in diameter and rotate at 40 RPM. Metal reduction also takes place with flattening down to, say. 30 per cent. of the original sectional area. The flattened rod is next further reduced in flat-die drawing machines with single bull blocks. Each of these strip drawing machines is driven by a 15-HP motor and the overall speed reduction is from 1,000 RPM at the motor to the finishing-block speed of 60 RPM. Transmission is first by V-belt, and then through a bevel wheel to the cone drive and finally by chain reduction to the take-off. Output varies according to the size of the material.

Interesting machines for winding the strip on to drums are each driven by a 5-HP, 1,000-RPM motor with simple V-belt transmission direct to the drum shaft which rotates at 40 RPM. Traversing gear for guiding the strip is operated by a thread screw with a hand wheel.

For the production of straight copper bars the raw material is extruded bar which is dealt with on a draw bench on which the bar, held at one end by dogs, is pulled through the die. The dogs are hooked on to a heavy-link chain which travels at 15 ft. per minute, being operated by 50-HP, 1,000-RPM motor. Driving is first on to a gear wheel and then to a worm reduction gear which propels a sprocket wheel over which the chain passes. Coiled bar is produced on a strip bench with a drive



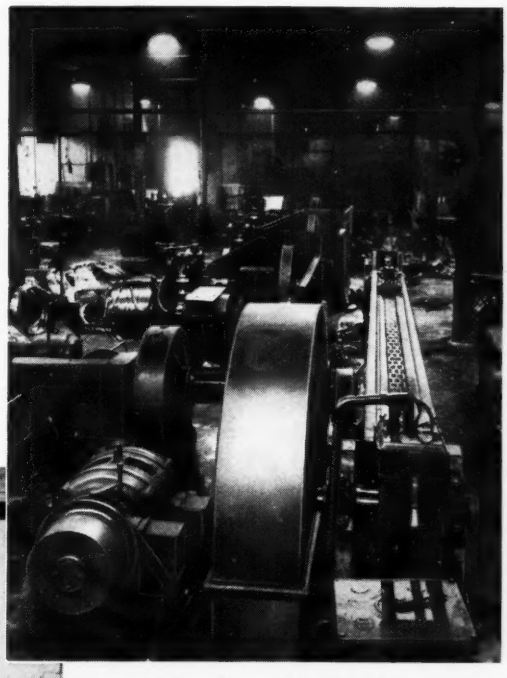


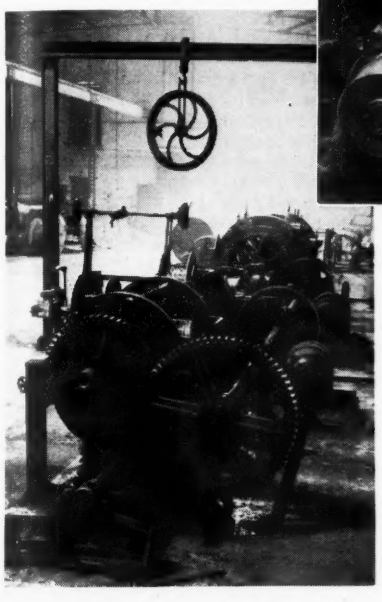
Left : Normally four bases are worked with each bell furnace, one heating up, one being filled and two being cooled (only one shown). Below : For the production of strip, copper rod is first flattened in rolls similar to those used for hot-rolling bars and plates

first through reduction gear to a main shaft running centrally right along and underneath the bench, and then via a bevel to each vertical draw block. The 90-HP motor runs at 1,000 RPM and the block speeds vary from 30 RPM to 45 RPM. A ton of wire can be dealt with on this machine in one continuous length—a particularly important feature in connection with the production of overhead trolley wire for traction work.

Bright Annealing

Because of the hardening effect of the drawing processes on wire it is necessary to anneal the product after each process. This annealing is effected in a bright annealing "Efco" furnace installation which includes two 50-kW bell furnaces, eight base containers and inert gas-producing and cleaning plant. The wire is placed on the base within an inner container and then the outer inverted container is lowered over the contents, to be water sealed at the bottom. All the air is then extracted from the container by means of a 1½-HP motor fan under the base and is replaced by the inert gas. Finally, the furnace proper is lowered over the filled and sealed container. The furnace is also water-sealed at the base. Normally, four bases are worked with each furnace, and while the bell is over one of these a second unit is being filled and the other two are being cooled down by water jets.





Left: Each section of the 19-bobbin strander has a 15 HP drive. Above: For straight copper bars extruded material is first dealt with on a draw bench (90-HP drive)

The whole process, including preparing, heating, cooling and unloading takes about four hours. In the refractory lining of the bell, between which and the case is 4 in. of special heat-insulating material, are three banks of resistors connected in three-phase star formation. These resistors are supplied at 292 V, phase to phase, so as to give an increased amperage of 99.6, as against 72.2 at 400 V.

The working temperature is from 500 to 700 deg. C., and is automatically controlled by Cambridge equipment, in the indicating instrument of which are two pointers. One of these is set to the required temperature, and the other is operated from the thermo-couple in the body of the bell. When the two pointers meet an electrical contact is made which operates a mercury switch. This breaks the circuit of a contactor coil on the main furnace switch and so the supply is cut off. When the pointers separate the initial electrical circuit is broken and the whole process is reversed, finally putting the main switch "in" again.

When the furnace bell is completely lowered a limit switch connected in the main contactor coil circuit is operated. In this circuit is also connected a heat fuse located in the furnace bell, and should this fuse melt by failure of the thermo-couple the contactor coil circuit would be broken. The furnace bells are moved along the line of bases by means of a 3-ton motor-operated Heywood lifting block, the necessary flexible connection being afforded by an 8-core c.t.s. trailer cable from a connector box on the wall. The eight cores include the three supply phases, two conductors for the heat-fuse and limit-switch circuit, and two temperature compensating leads for the thermo-couple, the eighth core forming an earth wire.

All the larger motors throughout the works are slip-ring units with rotor resistance starting and push-button contactor operation. All the motors up to 15 HP are squirrel-cage machines, and some of these are started direct-on-line by push-button contactor switches, the others having normal star-delta starting. The total horse-power of motors installed is about 1,200 to 1,500, the units varying in size up to a maximum of 150 HP.

We are indebted to the Spencer Wire Co., Ltd., for permission to visit the works and take photographs.

Drying Ceramics

SUCCESSFUL research in the drying of ceramic products by means of high-frequency AC is being conducted at the engineering experimental station of the Virginia Polytechnic Institute, Blacksburg, Virginia, U.S.A. The sample is placed between plate electrodes connected directly across the output condenser of a push-pull oscillator, the application of "raw" AC to the valve anodes not seeming to interfere to any great extent with the effectiveness of the field. Such inductive drying has economic value; it reduces the shrinkage period to 30 per cent. of the time needed when heat is furnished by resistor coils alone, but a combination of the two forms of heating may be suitable for some types of products. The structure of the samples is not detrimentally affected and the h.f. method should facilitate the drying of complicated shapes evenly over their cross-sections, which would ensure more rapid and safer drying. Only 26 per cent. of the power input required when heating coils alone are used is needed for h.f. drying.

Conventional drying by preheated moist air involves accurate control of both temperature and humidity to prevent the outer surface of the sample hardening first, so setting up cracking stresses. Induced h.f. heating keeps the centre hot, forcing moisture to diffuse outward, so replacing that evaporated from the surface and relieving internal vapour stresses which tend to warp and crack the ware. As the contained moisture moves outward the particles of clay settle closer together, causing shrinkage; the latter depends upon the water content, which largely governs the drying time. The rate of evaporation from the surface relative to replacement by diffusion from within is the all-important factor.

Magnetic Storms

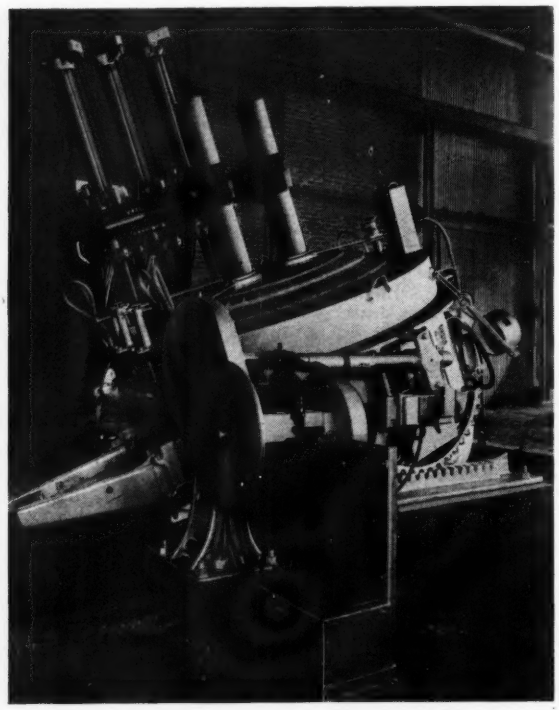
CONSIDERABLE disturbances to both radio and cable communications have been experienced in various parts of the world during the past week or two, more particularly on short-wavelength systems. In this country interference and interruptions were most marked in American and Scandinavian traffic. The disturbances are attributed to a stream of electrical discharges that emanated from a number of sunspots. In several countries the Aurora Borealis was observed.

Steel Melting in South Africa

Large Electrode Furnace

AN arc furnace recently installed at the Chamber of Mines Steel Products, Ltd., Johannesburg, by Birmingham Electric Furnaces, Ltd., is said to be the largest of this type in South Africa. It is in continuous operation for the melting of steel scrap from the various mines of the company. The metal as poured has a carbon content of 0.7 to 1.0 per cent., and is mainly used for billets from which balls, shoes and dies are made. The furnace is a standard "Lectromelt" rated at 3,600 kVA for a 2,000-V, three-phase, 50-cycle supply, with auxiliaries operating at 500 V. Its capacity of 190 cu. ft. allows for a charge of 7½ to 8 tons and a clear melted bath with a full cold charge, assuming that the furnace is already hot, is obtainable in approximately 1½ hrs.

The top charging arrangement enables the furnace to be entirely filled (within five minutes) and obviates the need to break up the scrap into small pieces. The roof is lifted and swung aside by means of a hydraulic ram located immediately below the electrode masts, and separate pistons control the lateral movement. In the working position the roof is



3,600 kVA electrode furnace for steel-scrap melting

clamped to the furnace casing and the ram is disengaged, permitting the furnace to be tilted by means of rocker trunnions, giving a wide angle of tilt—45 deg. forward for pouring and 35 deg. backward for fettling and slagging. This allows the stream of metal to be poured in approximately the same vertical line, eliminating the need for moving the ladle.

Three graphite electrodes, each 10 in. in diameter, automatically moved towards or away from the bath to maintain the required input, are supported by clamps and glands mounted at the extremities of horizontal arms, which bring the current to the electrode and supply cooling water to the glands. These arms are attached to crossheads sliding vertically on steel masts mounted at the back of the furnace. Counterweights and a friction drive stop movement of the electrodes when the furnace is tilted and when the path of the electrodes is obstructed, so that on the arms reaching the limit of their upward movement or the electrodes coming into contact with the charge, the cables slip on the drums, thus protecting the electrodes.

The main high-voltage truck-type circuit-breaker, by the English Electric Co., has a rupturing capacity of 150,000 kVA and is provided with a no-volt release coil. Four single-phase step-down furnace transformers (one being spare) were supplied by the British Electric Transformer Co., Ltd. The tilting motor is manually controlled by a tramway pattern, drum-type reversing controller. The electrodes are controlled separately by Westinghouse automatic equipment.

Picture Transmission in Colour

Development of American System

THE first patent covering a process developed during the past two years for wire or wireless transmission in colour facsimile was granted last October, based on the standard equipment and practice of the Finch system, with certain changes and adaptations in transmitter and receiver.

By transmitting the colour separation prints simultaneously with similar portions of each print scanned at the same time, variations which occur in transmission will not distort the final superimposed coloured facsimile. The three prints are arranged parallel with each other upon a single record sheet and scanned transverse to their parallel arrangement so that similar portions of the picture are simultaneously scanned. Any variations in the speed or alignment of the receiver and transmitter that might produce slight distortion in the three prints does so to an equal degree. So, when prints are superimposed after being received, they all bear similar distortion characteristics. Being symmetrical, they are practically unnoticeable.

While the patent describes the method as a novel one for transmitting coloured photographs and also as a "novel method of electrically transmitting the primary colour separation prints of a coloured picture to a remote point," transmissions to date have been from full colour print to three-colour separation positives, assembled into coloured prints by the usual photographic methods. The technique is basically the same as for a black and white, but a colour filter is interposed between the scanning eye and the picture on the drum of the transmitter. This contains triangular gelatine sections of the three primary colours, so that each in turn is filtered out and transmitted to be recorded by exposure of the film on the receiver drum.

The transmitting cylinder revolves at 300 RPM, while the colour disc, through which the scanner "sees" the picture, revolves but once in the same time. Thus the first colour selected for transmission is filtered out and sent. The receiver, in a dark room, has on its drum unexposed films of the same measurement as the full colour picture on the sending drum. The receiving drum revolves at only 100 RPM and has three times the circumference of the transmitting drum, so that it takes all three films, which record the three principal colours. When the transmitter has sent a complete line from top to bottom of a picture, the receiving drum has revolved only one-third of a revolution, covering a single line on one colour film. In this way the scanner selects and transmits impulses for the different colours, the receiving "electric eye" opening and closing to expose the films in the proper places for each of the primary red, yellow and green colours. It is necessary to know in advance or transmit an identification mark indicating the order in which the colours are being scanned. The colour filter may be started with any of the three colours and will automatically rotate through the series. Without identification of this order of scanning the colours, the person at the receiving end might, with certain pictures, meet difficulty in knowing which colour a film represents.

As recorded on the receiver, these films are positives. In assembling them into a picture the process is the same as in making the usual full-colour print of a photograph. Received positives are on thin translucent or transparent gelatine. After the film is developed it is bleached in the conventional manner and the separations are aniline dyed to their proper colour or toned with metallic salt solutions which combine with the silver retained in the print. Finally, the monochrome coloured prints are superimposed to form an integral final picture, laminated on paper or board back.

Silver Research

RECENT activities of the American Silver Producers' Research Project have been concerned with the lining of beverage cans with a film of vaporised silver, which has a mirror-like appearance and resists peeling. The value of the thin film is very small, so arousing commercial interest, while the Bureau of Standards is evaluating the merits of various linings as foundations for the silver deposit.

Other studies, according to the *Chemical Trade Journal*, have concerned silver electroplating at current densities as great as 240 A per sq. ft. Good coatings are said to have been obtained at rates of deposition up to forty times the normal, involving turbulent flow of the electrolyte. The possibility of electroforming vessels of complicated shapes, such as distilling flasks, has also been demonstrated. The effect of silver in amounts up to 0.15 per cent. upon the properties and performance of antimonial-lead storage batteries is being investigated.

FACTORY ACCIDENTS

Electric Power and Dangerous Machinery

By a Barrister-at-Law

A NUMBER of highly important and complex issues affecting users of electric power in connection with subsidiary factory processes have been considered by the Court of Appeal in the recent case of *Stimson v. Standard Telephones and Cables, Ltd.* At the defendants' New Southgate factory some 6,000 workers were employed, amongst them the plaintiff, a girl aged 14½ years. The plaintiff worked in a room devoted to photographic reproduction of documents and forms; it was divided by a tall steel filing-rack, which did not extend right up to the ceiling nor to the sides of the room, into two portions; in one portion a man and two boys were employed, and in the other some girls, amongst them the plaintiff. The girls were engaged on blue prints of working drawings which were made either for use in the Company's offices for preparing specifications for customers, or for use by their own employees in other parts of the factory where the Company manufactured telephone, radio and other equipment.

The plaintiff (and her father) claimed damages in respect of personal injuries which she had sustained in 1935 whilst working at a developing machine and a drying machine. She was holding a packet of sweets in her left hand, and with her right hand she was placing a wet blue print on the drying drum, when her hand was caught against the surface of the drum, which was heated from inside by electric elements controlled from switches to the right side of the drum; her thumb was somewhat severely burned (so that it was left in a deformed condition), tendons were exposed in the palm, and her arm also was burned. For eleven months she received workmen's compensation, amounting to £22; the Company then proposed a reduction, and she intimated her intention to resort to arbitration to oppose that proposal. Whilst employed by the Company she was an "unskilled" worker; she now went through a course of training and became a clerical worker elsewhere, and in her new occupation earned, in point of fact, as much as she might have expected to earn in her old employment. In 1937 she brought this action at common law.

Basis of Case

The plaintiff alleged against the defendants that they were liable in damages for breaches of both common law and statutory duties; at common law in that she ought to have been under proper supervision so as to be prevented from eating whilst at work, and under statute law in that, as she contended, her employers had contravened the provisions of Section 10 of the Factory and Workshop Act, 1901, and of Regulation 12 of the Electricity Regulations of 1908.

The 1908 Regulation requires that a switch controlling a motor shall be within reach of the person in charge; another girl had had to come to the aid of the plaintiff to get at the switch. Section 10 of the 1901 Act deals with the fencing of dangerous machinery and provides that:—

> (a) Every hoist or teagle and every fly-wheel directly connected with the steam or water or other mechanical power, whether in the engine-house or not, and every part of any water wheel or engine worked by any such power, must be securely fenced.
>
> (b) Every wheel-race not otherwise secured must be securely fenced close to the edge of the wheel-race.
>
> (c) All dangerous parts of the machinery and every part of the mill gearing must either be securely fenced, or be in such a position or of such construction as to be equally safe to every person employed or working in the factory as it would be if it were securely fenced.
>
> (d) All fencing must be constantly maintained in an efficient state while the parts required to be fenced are in motion or use, except where they are under repair or under examination in connection with repair or are necessarily exposed for the purpose of cleaning or lubricating or for altering the gearing or arrangements of the parts of the machine.

Now the machine at which the plaintiff was engaged at the time of the accident was a drum, 20 in. in diameter; in front towards the top was a roller extending across the entire width of the drum; a sheet of canvas-like fabric revolved round the roller from and towards two other rollers, one of which was at the top of the drum and the other behind. The space between the front roller and the surface of the drum was 2 in., whilst the drum revolved only at the rate of 1 in. per second; there was no finger guard. The Court ruled that the machine was dangerous, and that the failure to fence it was the real, effective cause of the accident. The defendants would, however, have been able to escape liability to the plaintiff if they had been able to show that she had been guilty of contributory negligence, and, in the view of the Court, they had failed so to do.

But was the plaintiff employed in a "factory," so as to be within the protection afforded in cases coming under the purview of Section 149 of the 1901 Act? Subsection (4) of that Section provides that "where a place situate within the close, curtilage or precincts forming a factory or workshop is solely used for some purpose other than the manufacturing process or handicraft carried on in the factory or workshop, that place shall not be deemed to form part of the factory or workshop for the purposes of this Act, but shall, if otherwise it would be a factory or workshop, be deemed to be a separate factory or workshop and be regulated accordingly." Furthermore, Section 149 (1) (c) defines (non-textile) "factory" thus:—"Any premises wherein or within the close or curtilage or precincts of which any manual labour is exercised by way of trade or for purposes of gain in or incidental to any of the following purposes, namely (1) the making of any article or of part of any article. . . ."

The Position of "Infants"

The plaintiff, it will be remembered, was doing "unskilled" work, and as such could properly be described as "exercising manual labour." The defendants had contended in the court of first instance that the plaintiff was not employed in a factory, but this contention does not appear to have been pursued in the Court of Appeal. Similarly, a contention raised by the plaintiff in the court of first instance was not stressed in the Court of Appeal, *viz.*, that the defendants were in breach also of their statutory duty under Section 26 (4) which provides that a woman or young person in a non-textile factory shall not work for more than a specified number of hours without an interval being allowed for a meal, and it was said that the plaintiff, on the day of the accident, had been kept working for longer than the period thus permitted.

The fact that the plaintiff was an "infant" raised further legal argument, for the defendants contended that having received payments under the Workmen's Compensation Act she had elected her remedy and could not now bring an action for damages. The plaintiff, on the other hand, contended—successfully—that being an infant she was entitled to re-open the matter by raising the question whether the arrangement which was made by her acceptance of compensation payments was, in fact, for her benefit. The Court held that it was not. This issue is of importance to all employers of "infant" labour, and particularly of female labour. For the damages which may be awarded at common law may far exceed the payments due under the Workmen's Compensation Act.

Earning Capacity

Under the Workmen's Compensation Act the only matter for consideration and assessment is the earning capacity of the injured employee. In this case, as we have seen, the plaintiff had, in fact, been able to earn in another occupation as much as she would have attained if she had continued to be employed by the defendants. (She had been offered light work by the defendants). But her earning capacity might well have been affected. The Court stressed the difficulty which always faces those who are called upon to advise in such accident cases, but emphasised one guiding principle at any rate, *viz.*, that the relevant date to consider is when the first payment under the Act becomes due; in this case, for instance, at the relevant date the full effect and consequences of the accident were unknown, and, as it turned out, the plaintiff suffered a partial, permanent incapacity, *viz.*, an injured thumb, and also permanent disfigurement.

To a young girl disfigurement may involve the loss of enjoyment of some of the important pleasures of life to which she might normally rightly aspire; her chances of matrimony may in some cases be diminished; and all these factors, as well as pain and suffering endured throughout the period of illness, are taken into consideration in arriving at a sum for compensation in an action at common law. Account is taken also of "special damage," *i.e.*, actual out-of-pocket expenses incurred by the person injured or by his or her parent (on behalf of that person).

In the result, the Court of Appeal affirmed the assessment made in the court below on the measure of damages, and the

plaintiffs were awarded the sum of £767, together with the costs of the proceedings before Mr. Justice Hilbery, who tried the case in the King's Bench Division, and before the Court of Appeal. The plaintiffs agreed to give the defendants credit for the amount which the girl had already been paid under the Workmen's Compensation Act; otherwise, a further somewhat involved issue would have required to be fought out—as to whether they could be compelled so to give credit.

It is to be noted that where a defence of contributory negligence is raised a different standard is applied where the plaintiff who is alleged to have contributed to the accident by his own negligence, so as to be the really effective agent of his own injury, is an infant from that which would apply where an adult is met with such a defence. This aspect of this class of case was fully discussed in *Murray v. Schwachman, Ltd.* (1937), where a circular saw was involved. In each case brought it is necessary, of course, to take into consideration all the surrounding circumstances, including particularly the precise section or process in or at which the injured person was employed, since numerous Statutory Rules and Orders have from time to time applied special regulations to special industries, factories, processes and machinery.

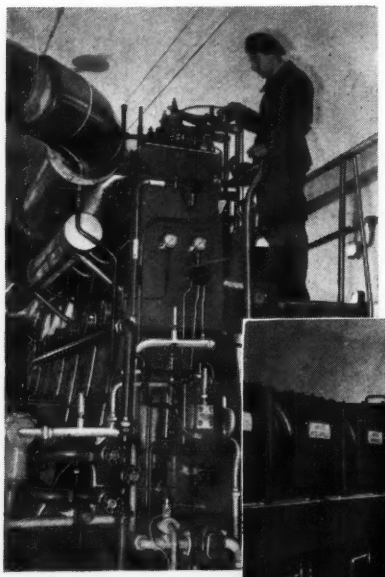
Stimson's case, again, arose under the Factory and Workshop Act, 1901, but on such matters as were here in issue the main principles have not been altered by recent legislation. Other cases on various aspects of the topics raised by *Stimson's* case which embody the leading principles on this branch of industrial law include: *Sharpe v. Southern Railway Co.* (1925); *Flower v. Ebbw Vale Steel, Iron and Coal Co., Ltd.* (1934); and *Potteries Electric Traction Co., Ltd., v. Bailey* (1931), where the status under the Factory and Workshop Acts, 1901-1920, of electrical workshops, welding shops, paint shops, gauge, template and tool rooms—all portions of one hereditament—was considered.

Of course, almost any machine may be dangerous to somebody in some circumstances, but regard will be had by the Court to normal human propensities whilst making due allowance for "the human factor," *i.e.*, the standard of an ideally careful person, judged by a theoretical standard not usually attained, will not be rigorously applied.

Electricity in the Maginot Line

An Important Factor in Its Efficiency

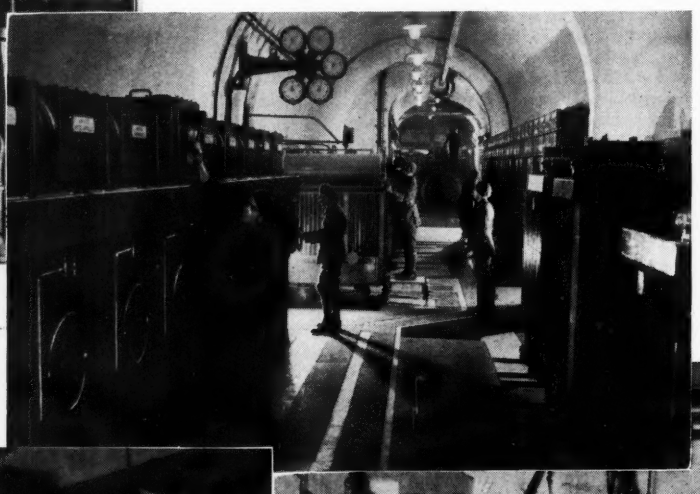
A CONSIDERABLE electrical load is provided by the lighting of the galleries and other subterranean parts of the Maginot Line, and by the power required in its transport systems, lifts, workshops and kitchens. While the French high-voltage network would be capable of providing all the necessary energy, it has been considered preferable, in view of war risks, to install Diesel generating sets in the most protected part of the fortifications. These sets are mounted on heavy concrete foundations provided with vibration-damping supports. Fuel oil is supplied through a filter by a pump from storage tanks in the foundations of the Line. Exhaust gases are expelled through conduits.



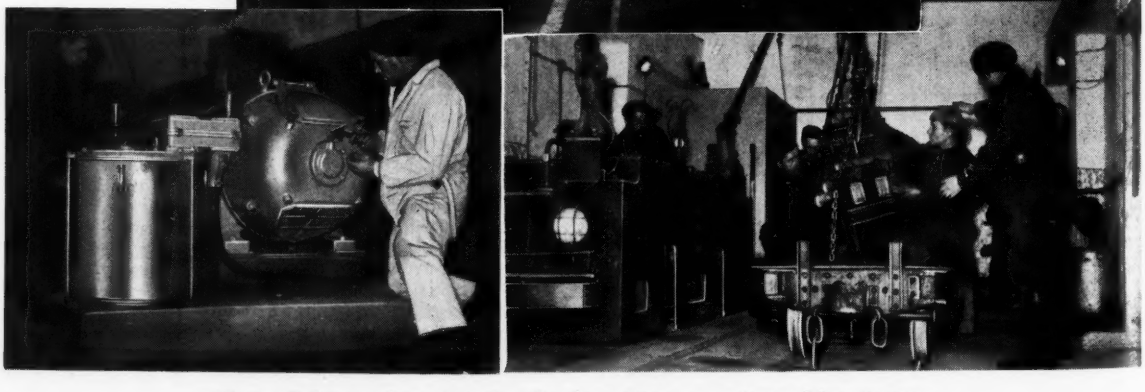
Immediately beyond each generating station is the step-up transformer substation. The transformers are set on small trucks running in tracks, which permit them to be easily moved out from their normal position against the wall for handling by an overhead monorail crane. Cables to and from the transformers are laid in trenches under the floor of the substation, covered by cement flags that provide easy access. Switchgear is of the iron-clad type. Double-faced measuring instruments are installed on brackets projecting from the wall, and are visible from any part of the station.

The most important consumption of energy is probably for transport, for which DC is obtained from rotary convertors in special traction substations. Small electric loco-tractors are fed by an overhead trolley wire running on insulators on brackets fixed to the walls of the tunnels out of reach of men standing on the floor. Trains of small vehicles are equipped either as flat trucks for the transport of material or with seats for the transport of men. Two trolleys are provided on the tractors to facilitate movement in either direction. Machine shops and welding equipment for repairs and kitchens, where electric ranges, ovens and electric boilers are installed, also take a large amount of the output.

The point of this wide use of electricity is that no air for combustion is required. Without electricity, the Maginot Line could not have been designed in the manner that it is.



Right: Substation in the Maginot Line, showing transformers and high voltage switchboard in the foreground. Above: Diesel set



Views of the traction substation showing rotary convertor and loco-tractor

PROVING REPAIR WORK

Tests Requiring Little Special Equipment

By R. A. Joseph, B.Sc.

A GREAT discrepancy exists between the tests applied to electrical equipment by manufacturers and those applied by the majority of small firms or works maintenance engineers who carry out repairs to the same equipment. While the manufacturer frequently subjects every piece of apparatus he sells to conditions simulating the most

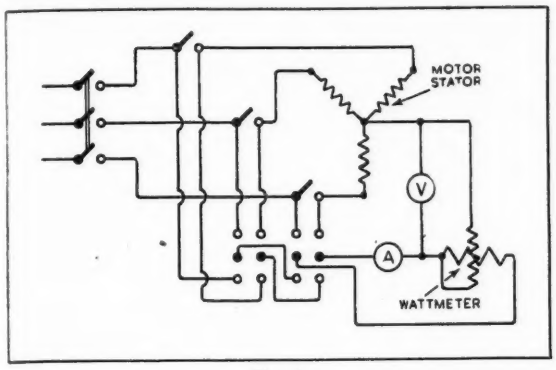


Fig. 1

severe it is likely to suffer, the maintenance firm will often allow a job to leave its charge without any very strenuous test.

For example, a manufacturer would probably pass more than full-load current through a DC motor, run it up at normal voltage and take flash and insulation tests, but a repairer will, after a complete rewind, often take only insulation tests between the commutator segments and earth and between the windings and earth. Is the manufacturer maintaining the price at an unnecessarily high level in order to be able to perform such tests or are those responsible for repairs exposing the users of the machines to unjustified risks of further breakdowns?

There is apparently no demand at all for repairs to be followed by tests which check points of design when the original pattern has been sedulously copied, and many of the tests are carried out solely to check materials and workmanship, neither of which can hope to be 100 per cent. efficient. The decision whether or not to test repairs must depend largely on the balancing of economic considerations with the technical factors and the repairer's sense of responsibility to the industry as a whole; that is, he should assist in giving electrical apparatus greater freedom from faults and so ensure its success over rival power systems.

Guarantees

Many firms have guarantee systems which cover breakdowns within a given period after a repair, and so they have to balance the cost of testing against the cost of breakdowns within the specified time. Their decision that testing is not financially supportable is frequently due to a vastly false idea of the actual expense entailed, both capital and current. To a repair firm carrying a stock of second-hand machines the capital cost incurred is not unduly large; a little ingenuity on the part of the engineer in utilising his machines in the best possible manner and in arranging a simple permanent testing layout is worth a great deal. The labour costs involved are but a small percentage of total labour and the power costs are very small if back-to-back, short-circuit, and other low-loss tests are employed wherever possible.

The majority of the equipment repaired by small firms is operated in the same locality from the same supply system so that all but a small proportion can be tested from one set of mains without necessitating expenditure on transformers and motor-generators. In such cases justification could be claimed for not applying full tests to the few jobs requiring some other supply voltage. Nor does every repair call for a full test; a single coil that has been replaced or a commutator repair does not require the same intensity of examination that should be accorded to a complete rewind. The customer has, however, every right to expect adequate tests when reasonably practicable, and the repair firm is equally justified in charging accordingly, explaining the extra cost. The evils and dangers of price cutting and the accompanying slipshod work are being increasingly recognised, which should render such an attitude within the realms of reasonable business.

Faults and Symptoms

The following types of fault would be revealed by tests. Poorly soldered or brazed joints causing heating and voltage drop, thus disturbing a balanced state, might exist for a considerable time, causing inefficiency without giving any outward sign other than high electricity consumption, which may easily be unnoticed in a large total load. Insulation defects are frequently only shown under the worst conditions of service but may easily be simulated on test. Incorrect connecting-up generally exhibits itself very easily but failure to run up a machine even at the repair works has frequently annoyed a customer most unnecessarily. The original design cannot often be copied exactly, and then the repairer or works maintenance engineer takes upon himself the responsibility of a designer. However capable he may be in this direction, it is always just as well to check for such faults as overheating due to decreased cooling or smaller section of copper, iron saturation causing power loss and so decreased efficiency, insufficient insulation and mechanical weakness.

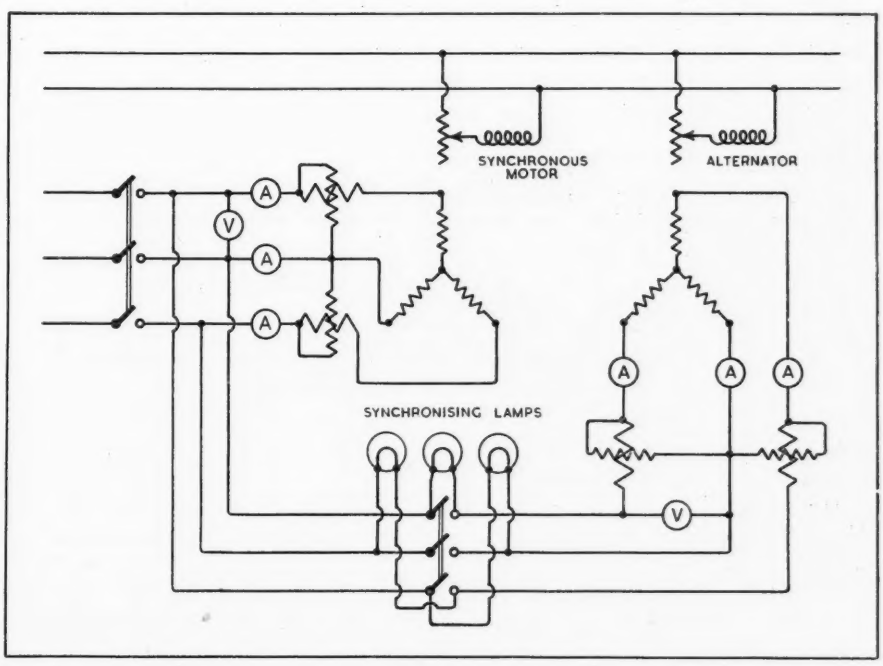


Fig. 2

The general assembly of an induction motor is checked by running it unloaded at approximately normal voltage. A motor should be started for a light run by the same method as will be used in service, e.g., direct to line, star-delta, &c., so that the correct conditions are imposed. The bearing

noise and magnetic hum should both be very small and the current in each phase should be balanced within about 3 to 5 per cent. in machines which are wound to run balanced. For these measurements one ammeter and one wattmeter will be quite sufficient. The wattmeter may be connected by the two-point method, but as balance should not be assumed a more suitable method of connecting is that shown in fig. 1, which enables the current and power in each phase to be measured on the same meters in turn.

The switches and meter terminals can conveniently be set up on a small panel and the meters need not be expensive or of very great accuracy. During the full-load test insulation faults will show themselves by failure of the machine or by out-of-balance currents and too great temperature rises. The machine may be loaded in one of three ways. With machines not exceeding 10 HP the load may be applied by a water-cooled brake, but the load is not easily kept steady and the method is wasteful and not generally satisfactory. It has the advantage that the efficiency is easily calculated from the input, the speed, the brake loading and brake radius. A brake can be constructed from a flanged pulley and a length of coarse canvas loaded with weights.

A second method of loading is to use the motor to drive a DC generator which will feed back into bus-bars or a resistance load. Resistance loading is very wasteful compared with feeding back, in which only the losses have to be supplied. This method is often useful for small and medium-sized machines when a DC generator and bus-bars of a suitable size are available. If the efficiency of the generator at various loads is known and its output measured, the efficiency of the motor is readily obtained.

Third Method

The third method consists of passing full-load current through the motor, but the power is reduced to a fraction of its full-load value by locking and short-circuiting the rotor, so that only a low applied voltage is required. This can be done by using a series resistance—a rather wasteful method—or a special alternator, which can generally be employed for all AC tests. A double winding with the twelve-phase ends brought out to a terminal board would enable the stator to be connected in series-star or delta, and parallel-star or delta, thus giving a wide voltage range which can be still further increased by field regulation.

The machine under test is connected to the alternator directly through the meters and the alternator field increased until the ammeters indicate that full-load stator current is flowing in the locked machine. The supply voltage is seldom more than a fifth of the normal and so the power used is small. But the power used in the heating of the stator copper is the same as on full load and so the heating and current balance may be observed. When the rotor is locked, cooling due to air drawn through it is absent. So, especially in large machines fitted with fans, it may be desirable to limit the current to rather less than the normal full-load value.

In this, as in all heating tests on machines, thermometers should be placed as near as possible to the copper in each winding as well as on the cores, frames and brushes. When a heat run is taken with a machine in motion the rotor thermometers cannot be fixed but they should be put in position as quickly as possible after closing down. The maximum readings will generally be reached soon afterwards, as heat is still transferred from the hottest point to the cooler points outside where the thermometers are fixed. The permissible temperature rises vary for various types of machine and for different parts and the appropriate British Standard Specification should be consulted.

The locked rotor test has the disadvantage that efficiency and power factor values at various loads are not available directly. Efficiency is approximately obtained by summating the no-load losses at normal voltage (iron, windage and bearing friction) and the short-circuit losses at the loading at which the efficiency is required, the output plus losses giving the input whence the efficiency can be calculated. Due regard should be paid to power factor and efficiency as low values will cause considerable unnecessary expense. The resistance of each winding should always be taken cold and hot to ensure balance, and each winding should be flashed to earth and to the other windings at the B.S.S. voltages.

Transformer Tests

The testing of transformers is not very different from that of induction motors. The ratio is ascertained on open circuit; if the transformer has several tappings all should be checked. Full-load heating is again obtained simply and without waste by a short-circuit test, the secondary being directly shorted by an ammeter (or its current transformer) while the primary is supplied at a considerably reduced voltage. Here also a special test alternator is useful although a series resistance will do.

Thermometers should be placed near windings when possible and also in the oil, if oil cooled and on the tank or casing. Again the efficiency may be computed from short- and open-circuit figures. As well as the flash testing, the transformer should be run on open circuit at a voltage of 20 per cent., at least, above normal for a short period. (This is frequently done with machines also.) Resistances hot and cold should be taken.

Synchronous motors are easy to load normally if a suitable alternator is available. The two machines are mechanically coupled and the alternator feeds back into the motor supply so that only losses are supplied from the mains. The method is shown in fig. 2. The efficiency of the motor can be found if the alternator efficiency is known and its output can be measured.

These are typical AC tests that demonstrate the general trend, without attempting to cover the full range of even machines frequently met with.

DC Testing

In DC machine testing similar methods are employed in order to prevent waste of large quantities of power. A DC motor, which may be considerably smaller than the one on test, is very useful and might be found in the second-hand stock. If no DC supply is available, a rectifier or convertor is necessary. A saving may be made by utilising the same DC motor for DC testing and for driving a test alternator. A good variable-speed AC commutator motor will be satisfactory, but is generally more expensive and in any case a DC supply is required. The difficulties of lining-up on a bedplate are not great.

Field strength and armature winding of a DC machine may be checked by driving the motor with its armature open-circuited by another machine. The open-circuit magnetisation curve is obtained from the volts across the armature and the field current. At the rated full-load field current and speed the armature voltage should be rather less than the normal applied voltage due to armature resistance drop. For small machines the heating curve may be obtained by loading either on a brake or by means of a DC generator feeding back into the supply or dissipating the load in resistances. As with induction motors, actual loading is not very often convenient and again a short-circuit method is usually adopted. This necessitates a separate drive and the brushes are shorted through an ammeter and circuit-breaker. The field—separately excited, whether series or shunt—is increased until, at a value of field current much lower than the normal, full-load current circulates in the armature. The machine will now heat up as if on full load. The brush voltage drop may also be investigated. Other normal machine tests, for instance, winding resistances, over-potential, and insulation tests, are also applied.

The efficiency of a DC machine is most conveniently found by the summation of losses, which gives a fairly accurate result. The machine, whether motor or generator, is run as a motor at no load and the total power input measured. This gives bearings, windage and iron losses. The I^2R copper losses are calculated from a knowledge of the hot resistances. Then at that loading the efficiency is calculated as—output/output—losses.

Thus it is seen that with the provision of very little special machinery and equipment quite exhaustive tests become easy to perform and should increase the quality of the work by showing faults at the right time and in the right place. At the same time the confidence of the customer is considerably increased.

Progress in Tin Research

A NEW type of electro-plating for tableware, cars, refrigerators, &c., is mentioned in the Report of the International Tin Research and Development Council. The coating consists of tin and copper in the proportions in which these metals are combined in speculum metal, the reflective qualities of which are used for telescope mirrors. The new application follows upon research into the simultaneous electro-deposition of tin and copper in these proportions. This speculum plating is hard, has a pleasing silver colour and high resistance to corrosion, and is expected to compete favourably with chromium.

Early in the year under review the building of the Council's new offices and laboratories at Greenford, Middlesex, was completed and the equipping of the laboratories has been proceeding. Devices for producing a better quality of tinplate are being tried and a process for producing a passive surface is being tested with canned foods. Precise directions for the electro-deposition of pure tin in any desired thickness upon other metals are being taken up by makers of food manufacturing equipment, as thicker coatings will give a correspondingly longer life than the hot-dipped coatings hitherto in use without a material increase in cost. Exceptionally strong tin alloys are another development and trials are continuing with a new class of bronzes for condenser tube resistance to corrosion.

TRANSFORMER NOISE

Recent Investigations with a View to Its Limitation

A QUANTITATIVE investigation of possible means of limiting the vibratory noise emitted by transformers was described in a paper by Messrs. B. G. Churcher and A. J. King (Metropolitan-Vickers Electrical Co., Ltd.), which was presented at the Institution of Electrical Engineers in London on March 28th.

To secure freedom from complaint with a margin, noise abatement of 20 phons or more was necessary, the authors stated. The ratio of the loudness experienced by a normal observer as between 70 and 50 phons was approximately 4.8 to 1. To effect a diminution of 20 phons required a reduction of the acoustic energy to about one-hundredth, and of the acoustic pressure to one-tenth, of their original values.

At present the choice of core materials having low magnetostrictive effect seemed hardly practicable, but circumstances might be altered by the development of new steels. The authors were chiefly concerned with "core" type transformers; they emphasised the need for careful interleaving of the joints and adequately distributing the clamping pressure provided by sufficiently extensive and stiff end-plates so that appreciable lengths of core were not left unclamped. Exceptional pressure did not appreciably reduce noise, neither did adhesively cementing the punchings together.

Remedial Measures

It was technically possible to effect a substantial reduction of noise level simply by lowering the flux density at which the transformer worked, but (especially in the larger sizes) this method was deemed to be quite impracticable economically. Study of the interception of vibration transmitted from the core to the tank showed that a compliant rather than a stiff or massive barrier or absorber was required (say cellulose sheet rather than metal) for internally surrounding the transformer on all four sides and able to withstand hot oil, the core standing on resilient supports.

It had also been proposed to provide external barriers; false sides mounted resiliently on the tank; or brick-built or concrete enclosures rather than kiosks. In such cases cooling of the oil would have to be effected by a separate external radiator flexibly piped to the tank. Proposals to "lag" the tank directly with soft material of low reflection-coefficient seemed to rest on confusion of absorption and attenuation.

If the principles of enclosure and isolation were carried to their logical conclusion considerable attenuation of the noise could be effected, but it was not easy to predict noise reduction by this means when an installation was being planned. The authors' colleague, Mr. S. W. Redfearn, had carried out a comprehensive mathematical examination of this aspect which it was hoped to publish shortly. The present authors gave a summary of the conclusions reached and examples of the ways in which the principles outlined might be applied to practical cases. Their research was claimed to put the subject on a quantitative basis not only with the assurance that noise could be limited to the desired level, but meaning that the results obtainable by alternative methods could be predicted, which was the first essential to ascertaining the most economic method.

If a building were not necessary, apart from the need to abate noise, sound limitation by absorbers within the tank had many points in its favour. Apart from a few internal fittings, normal design, installation requirements, cooling and electrical connections were not interfered with. Although a larger tank with additional oil would be needed, the extra cost and space occupied were small compared with those required for a building, which would have to be substantial and very large to enclose high-voltage transformers completely. Misdirected effort would be avoided only by taking a comprehensively broad view of a subject that comprised in addition to normal engineering considerations acoustical principles not widely known in engineering.

Discussion

Prof. R. O. Kapp opened the discussion by expressing surprise that there was no mention in the paper of the pioneer work carried out by Dr. Swaffield at University College on behalf of the Electrical Research Association between 1935 and 1938. Only three papers had previously been published on transformer noise. In all of them it was taken for granted that the noise was due to vibration of cores and plates, and the suggested remedies were based on this erroneous assumption. That the noise was due to changes in the dimensions of the materials due to magnetisation was nowhere mentioned. The presence of even harmonics seemed to rule out bodily movement, but the evidence of magnetostriction was more conclusive and had a quantitative basis. Measurement by a new technique was not easy considering the very small displacements to be measured; bodily movement of coils or plates was not wholly negligible.

The authors' complete assurance had been made possible by the mass of evidence so carefully prepared for them by Dr. Swaffield. The presence of magnetostriction was suggested by Dr. C. H. Desch (then with the National Physical Laboratory) to Prof. Kapp some four years ago, but no one seemed to have made a precise measurement. The virgin curve had been obtained in Japan by Hinda and Kido by a technique probably too crude for the purpose. Also by Schultze in Hungary with the ultra-micrometer, but it was not possible to record the hysteresis loop. For this purpose step by step readings with DC excitation must be taken, and difficulties of thermal expansion must be overcome. This might be 30 times the total magnetostriction expansion and was due to the heating effect of the exciting current. For plotting the hysteresis loop the interferometer was too crude an instrument. Therefore, measurements were made at University College with a Lamb's extensometer, a very accurate but simple device which was manufactured at the College for £15. Approximately one ten-millionth of an inch, or 0.4 per cent. of the total movement, could be measured, and Dr. Swaffield and Mr. Alexander plotted several magnetostriction hysteresis loops in this way. Prof. Kapp pointed out what he called a certain lop-sidedness and other curves obtained by Mr. Alexander with a cathode-ray oscillograph showed the same feature, which might provide a clue to a fundamental property of magnetism.

C.E.B. Experience

Mr. C. W. Marshall (Central Electricity Board), speaking of some 695 transformers with an average capacity of 17 MVA which had been in service for a period corresponding to about 5,000 transformer-years, said that during that period there had been 15 complaints, of which rather more than half came from the South-East England area, and reasonably near London, although in that area there were only 34 per cent. of the transformers. Six manufacturers were involved, and although some measures had to be taken to reduce the noise level, none of them was very extensive because few of the complaints were seriously justified. The great difficulty was that there was no definition of noise level, or any means of actually measuring noise. The C.E.B. was determined that there should be no relaxation of the rule that transformers should be as silent as possible, and the first thing to be done now was to establish reasonable noise levels which would not increase the cost of transformers.

Mr. E. T. Norris remarked that in most cases the problem was mixed up with the background noise and its masking effect. The authors had been unduly pessimistic with regard to the efforts of other workers in this field; the work of E.R.A. had been of very great value to transformer designers. He could not recall a single complaint of the noise of a transformer below 1,000 kVA.

Mr. N. Fleming, discussing noise inside buildings, said a great deal of information was available, but when using data one must take into account such things as badly fitting doors and ventilators, which seriously impaired the over-all insulation. In estimating the nature of the reduction to be expected from any given type of construction it was very necessary to take into consideration the "build-up" effect mentioned by the authors, which could be calculated approximately on the ordinary reverberation theory. Without special methods for sound absorption within the building there might be a loss of insulation of the order of 10 to 15 decibels. Therefore, it was desirable to provide such sound absorption within the enclosure. Double partitions, in general, had a greater sound insulation value than single, but they had marked selective transmission characteristics according to the frequency, and therefore it was necessary that they should be properly designed in relation to the particular noise against which insulation was required.

Mr. A. G. Ellis, remarking that complaints depended very largely on the nature of the residential property, said he did not think there was any demand for that super-perfect but equally uncommercial article, the silent transformer. Nevertheless, the time had come for the establishment of levels of noise which would be generally accepted for general working purposes. Swaffield's work for E.R.A. had, up to the present

time, been regarded as confidential, and it was to be hoped that the full details would soon be published. Personally, he did not think there was much more that designers could do until they obtained better steel of very low magnetostriction, but data on this matter was very scant. Burying transformers in the ground would be an advantage, not only as regarded noise but also as protection against air attack. Indeed, the burying of transformers might not be very much more expensive than building the walls recommended for A.R.P. purposes.

Mr. H. M. Lacey said that much work would be saved if it were possible to establish a fundamental law. An alloy of iron containing 81 per cent. of nickel had zero magnetostriction, and an iron containing 4.45 per cent. of silicon had positive magnetostriction, while with 8 per cent. of silicon there was negative magnetostriction. It had, incidentally, been established that a material with zero magnetostriction also had the minimum loss. That was probably significant in the theory of magnetism.

Dr. E. Billig said that the content of silicon had a bearing on the brittleness of steel. There was set up a magnetic force which would largely result in mechanical pull and cause mechanical deformation. Experiments gave him the idea that a great deal of the noise came from the joints. Where there was magnetic pull through the air gaps and actual mechanical movement in the gap noise was liable to occur; hence the importance of having perfect joints. He was inclined to think that cementing, adopted by the authors in their endeavour to get perfect joints—which was never possible—had had more effect than cutting down the magnetostriction.

Mr. J. S. Forrest remarked that, while the exact distance at which noise measurements were taken was not important, it should be standardised, although his experience had been that when the measurements were taken as close as possible to the tank there was less trouble from extraneous background noises. As to the variation of noise with distance from the transformer, tests had indicated that the noise in some circumstances might increase as the distance from the transformer increased. In his view the standardisation of noise levels was the next problem to be taken in hand.

Mr. R. S. Dadson asked whether the figure of 40 phons mentioned in the paper as the level at which complaints were liable to arise was the result of the authors' own observations, or if it was a figure which had been published elsewhere. In collaboration with the E.R.A. and the C.E.B., he had visited transformer substations where complaints had arisen, and his impression was that there was very considerable variation in the nature of the complaints. There were complaints where they would not have been expected and no complaints where they might have been anticipated. In some cases comparatively simple screening was sufficient. In the course of his visits it had seemed that the radial shell transformer was substantially quieter than the core type of corresponding performance.

Mr. A. J. King, in a brief reply, said that not only did the authors regard Swaffield's work as confidential but it was not available when the paper was written and, moreover, the authors could not agree that the absolute value of magnetostriction was by any means the whole story. It was quite possible that there was some other effect, such as the differential magnetostriction between adjacent laminæ. The permeability of steel varied from sheet to sheet due to small changes in heat treatment, to say nothing of the grain, so that, even if the magnetising force applied to the core were uniform, the magnetostriction would vary from sheet to sheet, owing to the variation of the permeability of the steel. He disagreed that there were no complaints concerning transformers below 1,000 kVA, and agreed with the necessity for a standard method of measuring transformer noise. The 40 phons mentioned in the paper as the level above which complaints were likely was the result of their own investigations. At the same time, the authors invited the experience of everybody else in order that a generally acceptable figure might be determined.

Death of Mr. W. B. Woodhouse

Strenuous Work for the Electrical Industry

IT is only a few weeks ago that Mr. William Bradley Woodhouse, as managing director of the Yorkshire Electric Power Co. and associated companies, addressed the shareholders at the annual meetings of the parent company and Electrical Distribution of Yorkshire, Ltd. The announcement, therefore, of his sudden death on Sunday last will come as a shock to his many friends in the electrical industry as well as to those who knew his work but had not met him.

Born in London in 1873, Mr. Woodhouse received his electrical training at Finsbury Technical College. After a spell of mining installation work in the Midlands and South Wales, he served an engineering apprenticeship with the Silvertown Company, and engaged in further study at University College, London. In 1895 he became a lecturer on mechanics and mathematics at Finsbury under Professor Dalby, leaving this post four years later to join the staff of the Newcastle-on-Tyne Electricity Supply Co. (now the North Eastern Electricity Supply Co., Ltd.).

[Elliott & Fry.
The late Mr. W. B. Woodhouse

In 1903 he was appointed engineer and manager of the Yorkshire Electric Power Co., which position, in addition to being managing director, he held until the time of his death. He was also chairman of the West Gloucestershire Power Co., Ltd. Fuel economy occupied his attention for many years. In 1913 he designed and set into operation a generating station using surplus coke oven gas as fuel, and he was an original member of the British Association Fuel Economy Committee; he was also associated with the development of coal carbonisation processes at both high and low temperature in conjunction with power supply. Mr. Woodhouse was closely associated with the use of electricity in mines, and was a member of the Institution of Mining Engineers. As electrical advisor to various collieries, he was responsible for the installation of many electrical winders, and the complete electrification of colliery power plants. He was a member of the Midland District Committee of Investigation appointed under the Coal Mines Act of 1930, and had acted as Government representative on the International Electro-Technical Commission. He played an active part in the affairs of the Institution of Electrical Engineers and was President in 1924-25.

Among his many other activities he was president of E.D.A. in 1923-24, president of the British Electrical and Allied Industries Research Association in 1927, and president of the Incorporated Association of Electric Power Companies from 1930-32. He had been chairman of the West Yorkshire Branch of the Electrical Industries Benevolent Association since 1935. From 1928-38 he held the post of chairman of the Conjoint Conference of Public Utility Associations and had been chairman of the Consultative Technical Committee for the Mid-East England area of the Central Electricity Board since 1932. He was vice-president and senior official British delegate at the International High-Tension Conference in Paris from 1925-33 and in 1933 he was a member of the conference to advise on the national re-organisation of electricity distribution. He had been a member of the Council and chairman of various committees of the electrical section of the B.S.I. and was one of the original members of the National Industrial Council and the National Joint Board for the Electricity Supply Industry. He was a member of the Institution of Civil Engineers and had contributed papers to the proceedings of a number of societies mainly on problems connected with electricity supply. He contributed articles to the ELECTRICAL REVIEW over a period of many years, and it was only recently that we published his proposals for the insurance of electricity supply undertakings against war damage.

The funeral service took place on Wednesday last at Bramhope Parish Church, and a memorial service was to be held yesterday (Thursday) at Leeds Parish Church.

Plug-in Instruments

AN addition to the variety of American Westinghouse instruments that can now be obtained in convenient detachable form is a time switch, a socket type being used to control the time of a tool-steel heat treating operation. Similarly, to facilitate their readjustment protective relays are made removable by equipping them with knife-blade terminals that mesh with jaws to which the wiring is attached. Switches are provided for automatically short-circuiting the current transformers when the relays are removed for attention. This mode of construction is also being successfully used for mounting watthour meters.

INSTITUTION PROCEEDINGS

Rotating Aerial Direction-Finders. Recent Corrosion Investigations. Future of Engineering in China

Radio Direction-Finding

PRELIMINARY results of an investigation of radio direction-finding on wavelengths of between two and three metres (100 to 150 Mc/s) with the aid of instruments fitted with rotating aerial systems, similar to those used in earlier work in the 6 to 10 metre band, were described in a paper by Drs. R. L. Smith-Rose and H. G. Hopkins, which was read before the Wireless Section of the Institution of Electrical Engineers in London on April 3rd. The paper was an official communication from the National Physical Laboratory, and the work described therein formed part of the programme of the Radio Research Board.

The sensitivities of the loop and Adcock direction-finders used were such that bearings with a swing of plus or minus five degrees were obtained with field strengths of 20 and 40 μV per metre respectively. The reciprocal error of the instruments had been reduced to one degree, and the polarisation error could be kept below 5 deg. for angles of incidence and polarisation to the vertical of 60 deg., although readjustment of the compensation arrangement was required to maintain this over an appreciable wave-band. The two direction-finders had been operated at various distances up to 30 miles from an experimental transmitter developing 100 W on a wavelength of 3 m., and the average errors varied from about 10 deg. at one mile to 3.5 deg. at 20 miles with a vertical transmitting aerial. These errors were somewhat larger than the corresponding values for the longer wave-band of 6 m. to 10 m.

Experiments in a Wooden Hut

When an attempt was made to use a direction-finder inside a wooden hut, the observations were subject to an octantal error of 2 to 5 deg. amplitude, the value increasing as the wavelength was reduced, due to reflection effects from the walls of the hut. Experiments made with various wooden boards showed that it depended upon the nature of the wood and direction of the grain. A synthetic material with no grain direction had only a small effect.

These effects were obviously of importance at very short wavelengths, and would be made the subject of further investigations. Considerable care would need to be taken in designing and housing such direction-finders. Possible solutions would consist in setting the instrument inside a quasi-cylindrical wooden structure, in using a hut made of material which was free from the effects described, or in placing the aerial system completely external to the hut.

There were no insuperable difficulties in the design and operation of instruments of the rotating-aerial type. The errors due to the transmission path along the ground and due to the site and immediate surroundings of the direction-finder were appreciably increased with reduction in wavelength. This factor might restrict the application of ground-to-ground direction-finding, while the possibilities of direction-finding on mobile elevated transmitters remained yet to be explored.

In Germany rotating "H" Adcock-type instruments had furnished three-metre bearings on aircraft transmitters at ranges between 10 and about 150 miles, the maximum error during a series of flights being three degrees.

Corrosion Research

RESEARCH work on corrosion by a group of investigators at Cambridge University (interrupted by the war) was summarised in a paper recently submitted to the Iron and Steel Institute by Dr. U. R. Evans, who suggested necessarily tentative interpretations of the results, the investigations having been carried out on behalf of the Institute's Corrosion Committee. The author's search for a convenient criterion of the protective character of a film had confirmed the belief that iron carrying interlocked oxide was better protected than specimens with somewhat thicker films.

The electrochemical nature of corrosion was indicated by Mr. J. N. Agar's exploration of the potential distribution close to the surface of zinc partly immersed in chloride or sulphate solution which had shown definitely that electric currents were passing between a cathodic zone, situated in the well-aerated region at the meniscus, and an anodic zone below it. Visible corrosion was always associated with the zone which the electrical apparatus showed to be anodic. From the distance between equipotential lines, the strength of the currents could be calculated, strong enough to account for at least the greater part of the corrosion—and probably for the whole of the corrosion leading to loose corrosion product (the small amount of adherent corrosion product had a different origin). The researches had not proceeded far enough to ascertain whether there was an exact equivalence between current strength and corrosion rate.

Dr. J. E. O. Mayne had developed a rust-inhibitive priming paint for wet steel by water-emulsification, pigmented with red lead and metallic zinc, but publication of its composition would be premature.

Possibly these zinc paints might also be useful in reducing corrosion fatigue. The chief new result from Mr. A. J. Gould's continued efforts in this direction was that zinc ribbon wound loosely round iron wire greatly increased the corrosion-fatigue life in chloride solutions, even when the access of the corrosive agent to the metal was not prevented. This was clearly due to cathodic protection. Owing to the low electrical conductivity of typical tap water, the apertures in the zinc covering must, in such cases, be made much smaller, if protection was to be obtained.

The new work of Mr. L. S. Price and Mr. G. J. Thomas on the tarnishing of silver was concerned mainly with the optimum conditions for the electrolytic production of an invisible protective film of alumina or beryllia on the silver. The amount of tarnish measured electrometrically agreed well with the gain in weight produced during tarnishing and the loss of weight produced during detarnishing. This agreement indicated that in suitable conditions the electrometric method of film estimation might be very valuable. It was possible to detect and roughly to estimate four different corrosion products in minute traces in the tarnish film; by ordinary chemical methods the simultaneous detection and estimation of these bodies would be practically impossible.

Engineering Standards in China

CHINA stands on the threshold of a new era in which it will become increasingly necessary, particularly in engineering, to define quality by means of standards and specifications. This was the opinion expressed by Mr. A. J. Percival (Inniss & Riddle (China), Ltd., of Shanghai) in his New Year presidential address to the Engineering Society of China.

He explained that, after the hostilities with Japan, China would gradually industrialise and at the same time restore her ruined means of communication and other public engineering services. In this great task she would need dependable guides to aid her in setting up standards of quality.

China would eventually evolve her own national engineering standards, but who was to prepare them and on what general principles were they to be laid down? The first of these questions might be said to have been already answered. It would be a Government department such as the National Bureau of Standards, which was formed about seven years ago by the National Ministry of Industries at Nanking and had done much excellent work prior to the outbreak of hostilities. Admittedly, it was contrary to the practice of the leading industrial nations to have their industrial standards initiated and determined by a Government department, but circumstances in China were such that it was unlikely that any suitable non-Government organisation for this important function would come into existence in the next decade. Therefore engineers could only co-operate with the Government and do their best to ensure that in this work their primary aim was to secure sound engineering standards.

Influence of Purchasing Power

Standards were ruled to a very considerable extent by purchasing power. In China this was lower than in any other country in the world. In consequence the habit of buying on price was perhaps more deeply engrained than elsewhere. Price was rarely a criterion of value. The final purchasing of engineering plant and materials in China was generally decided by people who were not engineers, and much was probably lost through lack of safeguards. The Shanghai Municipal Council had done excellent pioneering work in this direction under most difficult conditions.

In China it was still very difficult to obtain materials having the special and essential mechanical, thermal, and electrical characteristics inherent in quality engineering products, and,

(*Continued at foot of next page.*)

CORRESPONDENCE

Every letter must be accompanied by the writer's name and address preferably, but not necessarily, for publication. The Editors cannot accept responsibility for correspondents' opinions

Chief Engineers' Salaries

YOUR correspondent "1940" hits the nail on the head when he asks "to what extent have these associations the right to expect men who are not connected with them to refrain from applying?" What right indeed! The request is a gross impertinence, more probably designed, as events during the last few years have shown, to keep a "closed shop" on municipal and similar jobs for association members than to force employers to pay a formula salary. How else can one explain the frequent acceptance of "cut price" jobs by association members.

The phrase "whether connected with the electrical supply industry or not" is obviously designed to head off the many first-class younger men employed at present by electrical contractors, consultants and other bodies, who by the very nature of their present work have better administrative and technical training than men trained exclusively in supply undertakings, and who at the moment receive salaries which are low compared with even the "cut price" jobs now offered to municipal executives.

Many municipal councils will probably continue to "fall for" this "racket," but perhaps the power companies and some others are not so easily deceived. Nor do their achievements suffer by comparison. They will continue to go for first-class administrative technicians, whether culled from the same branch of the electrical engineering industry or not. There is surely no better way of infusing much needed new blood into the industry.

Qualified engineers are being deprived of their right to compete for and to occupy municipal jobs by these advertisements and by the insistence on "previous municipal experience," both requirements being probably inspired by the same source.

March 29th. ANTI-HUMBUG.

Three-pin Lighting Plugs

While the installation of three-pin, 15-A sockets for heating points is now generally accepted as good practice, the same cannot be said regarding lighting plugs. Of the three-pin lighting sockets in use to-day, 90 per cent. are used with two-core flexibles. Earthed metal standard lamps are almost unprocurable at electrical shops and supply authorities' showrooms, while insulated standards with earthed brass lampholders are unheard of.

Indeed, only in exceptional circumstances can they be considered necessary or desirable. This is implied by the footnote to I.E.E. Regulation 1001 permitting the omission of an earth connection to the earth contact tube of a socket in "earth-free situations." Living rooms and bedrooms usually have wooden floors and most modern houses and flats have glazed tiled hearths, thus making them earth-free for all practical purposes.

Comparing prices (pre-war) of two- and three-pin standard quality flush 5-A socket outfits, while the two-pin type costs 5s. 9d. for a switch socket, 1s. for a two-way adaptor, and 1s. 2d. for two plug tops, making a total of 7s. 11d., the corresponding prices for the three-pin type are 6s. 11d., 3s., and 2s. 6d., or a total of 12s. 5d.

In addition to avoiding an unnecessary 50 per cent. increase in cost, two-pin plugs offer other advantages. They are much neater, especially when multi-adaptors are used; three-way adaptors (which are not made for three-pin plugs) are cheap, thus enabling more outlets to be provided for standards, radio sets, &c.; and consumers are not given the false sense of security that often accompanies the use of three-pin sockets.

The last point is more important than is usually realised. I have often been told by householders, when some glaring example of bad electrical practice was pointed out, that it must be quite safe because they had got three-pin plugs!

At least one reputable firm is now marketing three-pin to two-pin adaptors, making the enforced use of three-pin sockets by many supply authorities of no avail. In certain unusual circumstances the earthing of appliances is, of course, absolutely necessary, but where they do not exist, why should all consumers be put to quite considerable expense?

Finally, with 5-A, two-pin sockets consumers have the benefit of standardisation, a word that has been very much over-worked lately by the electrical industry. In spite of the good work of the B.S.I., we have both 2-A and 5-A, three-pin plugs, as well as those with mutilated earth pins, to say nothing of the sockets which require special two-way adaptors to clear the switch dolly.

The installation of three-pin sockets where essential would ensure the use of appliances fitted with three-core flexibles, which would be used only for such positions. This would do far more to ensure safety than the almost universal use of two-core flex connected to three-pin plugs as at present.

Edgware, *March 30th.* JOHN BLAND.

Displaced Development Staffs

An incidental result of the Government's policy in restricting capital expenditure, to which I have so far seen no reference in your columns, is the invidious position in which the staffs of supply companies who are normally engaged in development and sales work now find themselves. As a specific case, which I do not imagine to be unique, the undertaking with whose expansion I have been associated in a technical capacity during the past ten years, has now informed me that my services will not be required in the near future.

On the other hand, Government schemes connected with our war effort are daily creating new vacancies to be filled from the Central Register which is compiled from the names of those who volunteered their services perhaps months before the outbreak of hostilities, and many of whom now find their employment unimpaired by the course of events. In these circumstances would it be asking too much if the Government's recognition of the position created by its policy could be expressed by directing that such vacancies should be filled where possible by those adversely affected?

April 1st. CHARTERED ELECTRICAL ENGINEER.

Neon Sign Contracts

In my article in the ELECTRICAL REVIEW of March 8th I showed that the Defence Regulations did not affect the legality of neon sign contracts. To this Mr. Moys, in your issue of March 15th, replies in effect that the point was never in question. I have raised a hare, he says, only to kill it.

But the facts are that far from the matter being academic, right from the inception of these Regulations Mr. Moys has been engaged meeting refusals by his hirers to pay. I have now seen documents issued by him to his sales staff and hirers. They show that so great was his anxiety that he consulted not one but three counsel who arrived at the same decision as I did, and for the same reasons. Mr. Moys had this opinion printed and circulated in summary to his staff to enable them to deal with threatening defaulters. Moreover, he invited his hirers to abandon the hiring agreement and enter upon one of absolute sale. Why then does he charge me with dealing with a non-existent problem?

Mr. Moys complains that I attacked the form of agreement affected by sign manufacturers without reason. Now this says: "We will specially construct and hire you a sign for a certain period, maintain it, and clean it. It remains our property, and you are to pay us for the hire of the sign and the services rendered. If you do not pay we may retake the sign." There is not a single word as to the passing of the property. Such a contract is governed by the ordinary rules of the two forms of simple bailment (hire of chattels and hire of labour) embodied in it, and the property remains in the bailor.

I have pointed out that specially to construct an article that is worth practically nothing if returned and to hire it out is remote from common sense. But what is more, I say that the document evidencing the transaction does not con-

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Institution Proceedings (*Concluded from page 399*)

moreover, precision production machines capable of turning out components to modern standards were almost non-existent there. Those were but two of the reasons why Mr. Percival hoped that the Chinese Government would take the earliest opportunity to modernise and strengthen its patent laws.

As an example of this need he mentioned that he recently had occasion to send to England for testing what appeared at first glance to be an exact imitation of a piece of imported apparatus in common use. The imitation was made in large quantities in Shanghai, and even the casting numbers were faithfully reproduced. The routine tests through which it was put in England revealed, among other weaknesses, that the fuse blocks were made of hygroscopic and inflammable material. This definite fire risk would be avoided if proper standards could be enforced in place of the jungle rule which was now the order of the day.

tain the true agreement between the parties, because there is without question an understanding that, in the end, the sign shall remain in the hands of the user and not be retaken as it would in a true simple bailment contract.

Mr. Moys tells us that the hiring agreement is adopted in preference to an absolute sale as it has "' definite advantages," without naming one of them; that the distinction is one of a "purely financial nature," without saying what this financial nature is. The real point is: "Is the written document one which honestly reflects the true contract between the parties?" In his opening words in giving judgment in Helby *v.* Matthews, the Lord Chancellor said:

> "The substance of the transactions evidenced by the agreement must be looked at, and not its mere words. . . . The parties cannot by calling it a hiring, or by any mere juggling with words, escape from the consequences of the contract."

This has always been a guiding principle in the courts.

Probably the financial reason on which Mr. Moys relies is that of income tax. This point is one of great importance: in fact, the adoption of this form of contract may mean a loss of at least a million pounds a year to the revenue. And it is procured by a misrepresentation; innocent, of course. The written contract presented to auditors and Income Tax authorities to support the abatement in income tax is not the true contract. And if the true effect of the agreement were written in the document by adding a clause that at the conclusion of the hiring the goods were to become the property of the hirer, no income tax deduction would be allowable in respect of that portion of the price which relates to the hire of the sign.

Hiring agreements are not the sole perquisite of the sign industry, and, if justifiable, the principle could be extended so that any manufacturer could equip his works throughout with plant and completely relieve himself of income tax for many years by adopting the expedient of causing the plant to be installed on a hiring contract of this kind. As under a hiring contract the property in the sign purports to remain in the manufacturer, a host of complications may ensue. A sign manufacturer's liquidator could hold all the company's old users up to ransom by threat to retake. Again, if at the end of the agreement period a user proposed to enter upon a maintenance contract with another manufacturer, the maker could remove the sign .

I invite Mr. Moys to say (1) What arrangements are made at the time the agreement is made as to the ultimate property in the sign and as to its removal, and (2) To whom the sign belongs at the end of the agreement period and afterwards.

In conclusion, I invite sign manufacturers seriously to consider the position. Let them adopt either an absolute or conditional instalment sale agreement. Their position would be greatly bettered, and their written contract would correspond to the true agreement. E. P. Hollis.

Twickenham, *March 25th.*

Transformer Fire Risks

Mr. E. T. Norris's letter in the Electrical Review of March 29th is most welcome, but I cannot agree with his remark that a transformer which would be incapable of initiating a fire might not be even feebly fire-resisting. A close study of records has shown that the number of fires in connection with transformers, and started by external agency, is negligible where transformers not filled with oil or other compound, are concerned.

Mr. Norris supports this view when he says that the ordinary air-cooled transformer goes a long way towards being fire-resisting. There have been rare cases where such transformers have been damaged or destroyed, when the building in which they have been installed, has itself been destroyed by fire, but by reason of their containing little material which would burn, they have not added to the magnitude of the fire.

As regards fires which are started by internal trouble in transformers, I think it will be agreed that these are, in every case, due to damaged insulation. The ordinary air-cooled transformer is insulated with materials which can burn, and consequently the failure of the insulation can easily result in the destruction of the transformer. By their very construction, such transformers cannot safely deal with sustained overloads, or other severe service conditions, without deterioration of the insulating material. Such deterioration frequently leads to the breakdown which initiates a fire.

If, therefore, transformers can be constructed with new types of insulation which are capable of withstanding the severe loading conditions imposed on modern transformers, without deterioration, a step forward has been made. Further, if such insulation is, in fact, non ignitable, I submit that the resulting transformer is well described as fire-resisting.

Mr. Norris's second paragraph refers to cost. Here, again, practical conditions must be taken into account. I repeat that the fire-resisting transformer is little, if any, more expensive to the purchaser than the ordinary air-cooled transformer.

I am afraid I cannot agree with the statement that the cost of large air-cooled transformers would approach that of similarly rated alternators, but here I had in mind limits of the order of 5,000 kVA, when I stated that, in my opinion, much larger units than those at present obtaining, will be manufactured. I agree with Mr. Norris that such large transformers as are used in connection with main generators, in sizes up to 75,000 kVA, cannot at present be contemplated with air cooling. Transformers & Welders, Ltd.,

Watford, T. F. Altham,
April 1st. *Managing Director.*

Circuit Breaking

Referring to the article by Mr. C. J. O. Garrard in your issue of March 23rd, the demonstrated obsolescence of what has for long been an accepted fundamental of high-voltage breaker design—the race between the rising value of the restriking-voltage transient and the rising gap-resistance after initial rupture must represent a new conception to many. Apparently it is desirable to strike a balance betwen the rate of rise of the recovery voltage and the gap dielectric value, *i.e.*, to prevent restriking, deionisation must be rapid, but on the other hand, gap resistance should not build up too much until the restriking transient has been effectively damped by the ionised leakage path.

It is clearly suggested by Mr. Garrard that this "buffering" of the voltage transient by permitting short persistence of a leakage current is of greater importance than a very rapid rise in gap resistance. This being the case, one wonders if it would not now be commercial to shunt heavily rated breakers with an auxiliary breaker in series with a reactor which would pass a given fraction of the fault current. This could be made to trip out after the main switch on a time-delay basis (adjustable, if necessary, to suit individual circuit characteristics) to clear the residual fault current under optimum conditions. The main breaker could thus build up its gap resistance with all possible speed, the restriking voltage transient being damped separately.

On very high-voltage systems such an arrangement could easily be cumbersome, and may from other considerations be undesirable, but at points of major importance, or in a network where the maximum fault conditions cannot be accurately assessed, it might be justified. J. R. C. Moore.

Little Melton, Norfolk, *March 28th.*

Liverpool Grid Supply Costs

A REPORT issued to members of the Liverpool Electricity Committee sets out the relations between the Corporation and the Central Electricity Board in regard to generating costs. It is stated that the price to be paid to the Board for electricity generated at Clarence Dock and Lister Drive power stations for use in the Corporation's area can be based upon: (a) the cost of production adjusted for load factor and power factor of the local supply plus the Board's expenses; (b) the grid tariff; (c) a cost not exceeding that at which the owners could have generated under independent operation.

For Clarence Dock, which exports about 500 million kWh to the grid, the alternative (a) would probably be the lowest, but its adoption is not open to undertakings benefiting from the "pool" for the N.W. England and N. Wales Area. By virtue of this arrangement a proportion of the profit from grid operation in the area is shared among the undertakings concerned. The C.E.B., it is pointed out, maintains standby plant at its own cost. The share of the pool accruing to the Corporation during the last quinquennial period has amounted to approximately £55,000, in addition to which advantages have been gained from the rateable value of the power station and in an increase of employment on its construction and operation.

The Corporation therefore takes its supply from the Board at the cost which it would have incurred with independent generation. During 1938-39, Clarence Dock sent out 938 million kWh, costing 0.217d. per kWh, and Lister Drive 115 million kWh, costing 0.644d. Of this output of 1,053 million kWh, supplied to the Board at 0.264d. per kWh, 584 million kWh was repurchased by the Corporation at 0.345d. per kWh.

Mine Trailing Cables.—The British Standards Institution has revised B.S.S. 708 (Trailing Cables for Mining Purposes) and made an addition as well as some small modifications, so that the specification now covers (1) flexible trailing cables for use with coalcutters and similar purposes, (2) pliable armoured trailing cables for use with conveyors, loaders, &c., and (3) a section dealing with drill cables.

PERSONAL AND SOCIAL

Information regarding new appointments and other matters of interest for this page are welcomed

THE annual smoking concert of the Association of ex-Siemens Men is essentially an informal function at which members gather together to renew old friendships, and the business side of the proceedings is therefore disposed of as rapidly as possible. This year's concert was held at the Bedford Corner Hotel, Tottenham Court Road, W.1, and under the genial chairmanship of **Mr. J. Snow Huddleston** the business proceedings were got through in record time. Mr. Huddleston referred with regret to the death during last year of Mr. E. P. Barfield (one of the joint honorary secretaries) and Mr. T. Gladdy, and the members stood in silence in tribute to their memory. Messrs. J. P. D. Coleman, E. H. Freeman, W. Kirkham, G. C. McPherson, E. North, H. G. Wainscott and R. W. Whitley were elected members of the Central Committee for the ensuing year. Mr. R. R. Griffin was re-elected secretary, and Mr. P. C. Pope, treasurer. These matters having been disposed of, a first-class entertainment followed, which was only interrupted at 9 p.m. for the time-honoured toast of "Absent ex-Siemens Men." "Auld Lang Syne" and the National Anthem brought to a close a thoroughly enjoyable evening.

Mr. F. B. Lydall, a director of the Yorkshire Electric Transformer Co., Dewsbury, was married to Miss Vera Louise Heppleston, at Morecambe, on March 27th.

Mr. E. F. Westwood, chief technical assistant with the Mid-Southern Utility Co., has been appointed borough electrical engineer to the Morecambe and Heysham Corporation. Before joining the Mid-Southern Co., Mr. Westwood was with the Barrow-in-Furness Corporation Electricity Department.

Sir Felix J. C. Pole, chairman of Associated Electrical Industries, Ltd., has been elected chairman of the Edison Swan Electric Co., Ltd., and Edison Swan Cables, Ltd., in succession to the late Mr. C. F. Spencer.

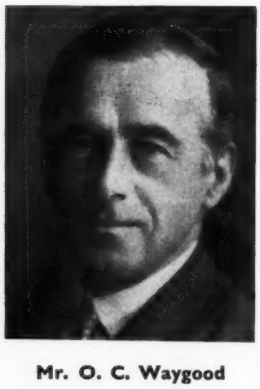
Mr. E. M. Benjamin has resigned his position as commercial manager of the North Wales Power Co., Ltd., and Electricity Distribution of North Wales & District, Ltd., which he has held since 1934, and has been appointed business manager of the Bristol Aeroplane Co.'s new aircraft factory, where he has already taken up his new duties. Mr. Benjamin is not a newcomer to the aircraft industry as immediately prior to entering the electricity supply industry he was for eleven years company secretary of Petters, Ltd., and Westland Aircraft Works, and previous to this he was with Handley Page, Ltd.

Through the kindness of **Mr. H. A. Lingard,** a director of the British Thomson-Houston Co., the lighting of the new church of St. George, Hillmorton Paddox, Warwickshire, will be carried out free of charge. **Mr. Briggs,** a director of Electrical Installations, Ltd., has promised that the wiring shall be done free of cost.

Mr. C. Anderson, A.M.C.T., A.M.I.E.E., chief assistant engineer in the Douglas (I.O.M.) Corporation Electricity Department, has been gazetted lieutenant in the Royal Army Ordnance Corps.

Mr. E. R. Whitehead, works supervisor with Dorman & Smith, Ltd., who has retired, has been presented with an inscribed gold hunter watch by the directors of the company, as a mark of their appreciation of over fifty years' service.

Mr. O. C. Waygood, M.I.E.E., is retiring from the Committee of the Mersey and North Wales (Liverpool) Centre of the Institution of Electrical Engineers after twenty-one years' service, during which period he has served as honorary secretary, and in 1935 was chairman of the Centre, and to mark the occasion a presentation of a silver tea service was made to him at the annual meeting of the Centre on April 1st. Mr. Waygood was educated at Manchester College of Technology, and served his apprenticeship with Mather & Platt, Ltd., from 1903 to 1908. He became assistant engineer to the Sunderland Forge & Engineering Co. in 1909, and in the following year joined the English Electric Co., Ltd., as assistant engineer, taking up a similar position shortly after with the Metropolitan-Vickers Electrical Co., Ltd., with whom he remained until 1919, when he was appointed lecturer at Liverpool University. He left there in 1931 to join Lewis's, Ltd., with whom he now holds the position of chief engineer.



Mr. O. C. Waygood

Mr. A. Burgess retired from the position of installation engineer with the Walthamstow Borough Council's electricity undertaking at the end of last month after over thirty-seven years' service. On behalf of the employees Mr. G. R. Spurr, borough electrical engineer, presented him with a set of bowls, an electric clock and an electric kettle.

The City of Birmingham Electric Supply Committee, at its meeting on March 27th, appointed **Mr. F. W. Lawton,** M.I.E.E., M.I.Mech.E., deputy chief engineer and manager of the Electric Supply Department. Mr. Lawton served his apprenticeships with W. E. Bates & Sons, of Northwich, and C. A. Parsons & Co., Ltd., and received his technical education at Armstrong & Rutherford Colleges, Newcastle-on-Tyne. In 1912 he was appointed engineering assistant to the city electrical engineer of Stoke-on-Trent, and in 1914 joined the City of Birmingham Electric Supply Department. He became first assistant constructional engineer in 1927, and three years later was appointed special technical assistant to the chief engineer and manager, being subsequently appointed chief assistant engineer. It will be recalled that in 1938 Mr. Lawton was awarded the Ayrton Premium by the Institution of Electrical Engineers for his paper on "The Design & Operation of Hams Hall 'A' Power Station."

Mr. F. W. Lawton

Mr. C. H. Yeaman, the city electrical engineer of Stoke-on-Trent, retired on Saturday last. We regret to hear that he has not yet recovered from the illness which has kept him away from his duties for about two months and hope that he will soon regain his health and enjoy a well-merited rest after his active career. For the time being the affairs of the Stoke Electricity Department are being looked after by **Mr. H. L. Mills,** the deputy electrical engineer, and **Mr. H. Lockett,** commercial assistant.

Mr. J. Lightbown, principal technical assistant in the Nuneaton Corporation Electricity Department, has been appointed to succeed **Mr. S. Cameron Gibson,** who is retiring on May 24th from the position of borough electrical engineer, which he has held for over twenty-eight years. Mr. Gibson is to continue to act in a consultative capacity for twelve months. The position of principal technical assistant is to be advertised.

Mr. James Rankin, F.C.I.S., the secretary to the British Power & Light Corporation, Ltd., and subsidiary companies, has been appointed to the board of the North Wales Power Co. and Electricity Distribution of North Wales, Ltd.

Mr. T. Roles, city electrical engineer and manager at Bradford, is to retire on superannuation in June and the Corporation Electricity Committee has recommended that **Mr. W. Dundas,** deputy electrical engineer and manager, shall be appointed to succeed him.

Obituary

Mr. J. Mercer.—We regret to announce the death on March 24th of Mr. James Mercer, manager of the Witton Engineering Department at the London headquarters of the General Electric Co., Ltd. Mr. Mercer, who was sixty-three years of age, joined the company in 1899 and went from Witton to London in 1910 to take up the position he held at the time of his death. He leaves a wife and two sons, both of whom are with the G.E.C. The funeral took place on March 28th.

Mr. R. Kennedy.—The death occurred recently at the age of seventy-one of Mr. Richard Kennedy, chairman of Kennedys (Bournemouth), Ltd., electrical factors. Mr. Kennedy joined the firm of Frederick Betts, Ltd., wholesale merchants, and became manager of their Bournemouth branch. When Betts went into liquidation in 1904 Mr. Kennedy took over the Bournemouth branch and in 1912 the organisation became a private company with Mr. W. T. Clegg as the other director. Mr. Clegg succeeds Mr. Kennedy as chairman of the company.

Mr. S. Garnett Roddan.—When seeing his chief, Mr. P. J. Robinson, off on March 27th to attend a conference in London, Mr. Samuel Garnett Roddan, chief statistical clerk in the Liverpool City Electrical Engineer's Department, had a fatal seizure at Lime Street Station, Liverpool. Mr. Roddan, who was fifty-eight, had been in the Department since 1895.

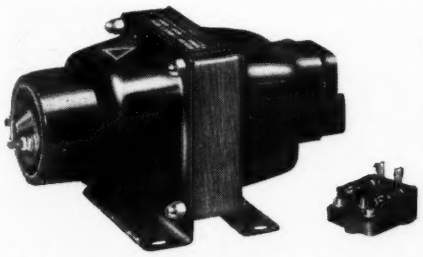
Mr. J. A. Hobson, the well-known economist and writer, who died on Monday last, was the father of Mr. Harold Hobson, general manager of the Central Electricity Board.

NEW ELECTRICAL PRODUCTS

A Review of Equipment Recently Marketed

Handlamp Transformer

A HANDLAMP transformer produced by the BRITISH THOMSON HOUSTON CO., LTD., Crown House Aldwych, London, W.C.2, complies with B.S.S. 794 and Home Office Regulations and provides an output potential of 12 V. It is of the air-insulated type and is provided with separate input and output windings, which are adequately insulated from each other. The connection of one end of the secondary winding to the earth terminal of the transformer ensures absolute safety in the remote event of a short-circuit between windings. A stout metal case encloses the windings, but the unit is not intended as a portable appliance, lugs being provided for permanent fixing to a wall or other flat surface.



B.T.H. handlamp transformer with 5A fused output plug removed

On the primary side there is an enclosed terminal board, while the secondary side is provided with a special socket and a 5-A fused plug with prong contacts. These contacts are not interchangeable with mains plugs. A locking screw is fitted to the plug and the fuses are of the cartridge replaceable type. The transformer, together with a suitable handlamp, is designed for use instead of mains connected inspection lamps in such places as garages, workshops, tramway pits, boiler houses, breweries, farms, &c., in fact in all cases where moisture or damp prevails. The unit is suitable for use in tropical climates.

Ventilated Lampholder

Special attention has been paid to ventilation in the new "Agro" No. 6060 lampholder introduced by T.M.C.-HARWELL (SALES), LTD., Britannia House, 233, Shaftesbury Avenue, London, W.C.2, three holes being provided in the top of the cap and others just above the thread for the cap. The shoulder of the cord grip is at the highest point of rise of the plunger to avoid straining the flex, while the plungers are solid with square terminal heads to prevent rotation. The well-threaded shade ring is of generous proportions and there is a metal liner inset from the edge of the holder.

Electrical Accessories

Several new electrical accessories are now available from CONTACTUM, LTD., Victoria Works, Edgware Road, Cricklewood, N.W.2. Two- and three-pin 15-A, double-pole horizontal switch sockets are supplied in both surface and flush types, with or without shutters, the cost being only slightly higher than the single-pole types. They have an all-insulated vitreous china interior. Side entry 15-A switch sockets are made in two- and three-pin and single- and double-pole models, either all brown, all white or brown on white.

A quick-make-and-break positive action is incorporated in a new range of 5-A shock-proof ceiling switches available in surface or semi-sunk types. New 5-A bell pushes include both round and rectangular surface units, a round semi-sunk type and a square flush type.

Fan Heater Improvements

Various improvements in the "Driver" electric fan-heater are announced by W. T. DRIVER, 36, North Road, London, N.7, and a new 8-in. model for AC is available, with a green, brown or oxidised metal finish.

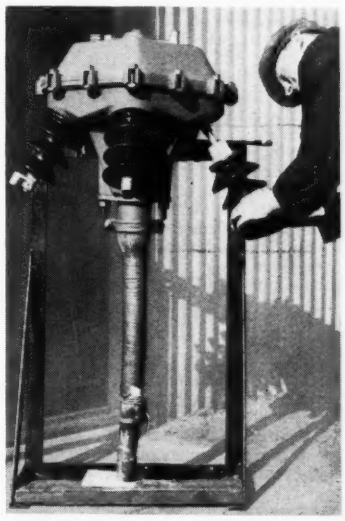
Electric Lift Development

Occasionally a goods lift, which is normally required to handle light or comparatively light loads at fairly high speeds, has to cope with an exceptionally heavy load, as for example when new machinery is being installed. It is clearly uneconomical to install say a 2-ton lift which rarely carries loads exceeding ½ ton, unless it can be arranged to do so at a considerably higher speed.

For this purpose the EXPRESS LIFT CO., LTD., Abbey Works, Northampton, has developed a special form of worm reduction gearing incorporating double reduction back gearing, which enables heavier loads to be lifted when the occasion arises, with a proportionate decrease in lifting speed. The ratio of the spur gearing is usually 4 : 1, so that a lift which normally raises loads of one ton at a speed of 120 ft. per min. could raise occasional loads of two tons at a speed of 30 ft. per minute.

Outdoor Dividing Box

There has been added to the already wide range of distribution appliances offered by CALLENDER'S CABLE & CONSTRUCTION CO., LTD., Hamilton House, Victoria Embankment, London, E.C.4, a pole type outdoor dividing box with a two-piece porcelain bushing which facilitates replacement of a damaged external insulator without dismantling the box, thus saving considerable time and reducing expense.



Callender's outdoor dividing box with insulators which can be changed in service

The box is an inverted type, designed for 11 kV 3-phase. Each external insulator can be removed, interchanged and replaced without leakage of the filling compound and without effect on the electrical performance of the box in practice. Even where bituminous compound is used, there is no difficulty in removing insulators after heat from a blowlamp has been applied to the box in the region of the insulator base. The successful performance of the box under voltage tests as specified in B.S.S. No. 223 indicates that the exchange of the insulators can be safely accomplished in service.

An "International" Socket-outlet

To render more universal the use of plugs with round pins made to British Standard gauges and plugs with flat pins of the types manufactured in the United Kingdom, Australia, Canada, New Zealand and the United States, all of which are now freely available in many parts of the world, a new patent three-pin "International" 10-A socket-outlet, has been recently placed on the market by J. A. CRABTREE & CO., LTD., Lincoln Works, Walsall.

Crabtree "International" socket-outlet

Although not larger than the more usual socket-outlets, it will receive and make good contact with three-pin plugs of either type and will also accommodate certain Continental round pin plugs. The flush pattern is provided with a standard vertical fixing yoke for securing it to the box and is also suitable for assembly with any box of "American" flush type. When installed with metal conduit this yoke also establishes earth continuity. The plate is of plain "Jacelite" shockproof material. The surface-mounting pattern is enclosed in an overall cover of the same material. All current-carrying parts are shrouded by vitrified English porcelain and the contacting component consists of only two parts so assembled that distortion is avoided.

COMMERCIAL and INDUSTRIAL NEWS

Electric Vehicle Exhibition at Cardiff. Current-Transformer Production. Works Change-over. Vitreous Enamellers' Exhibition. Approved Electrical Apparatus in Canada.

South Wales Electric Vehicle Exhibition

AN exhibition of electric battery vehicles was held at Castle Garage, Cardiff, on April 3rd and 4th. A fully representative collection of vehicles by five manufacturers was on show.

The display of Associated Electric Vehicle Manufacturers, Ltd., consisted of a 12-cwt. capacity Morrison chassis, of standard construction, fitted with a body suitable for bakers; a 12-cwt. Morrison chassis fitted with a tower for inspection and maintenance of street lighting; a 1-ton capacity Morrison chassis fitted with van body suitable for laundry collection and delivery; and a 5-ton capacity Electricar chassis, which was lent by the Cardiff Corporation Electricity Department, to which it is in course of delivery for use on the general mains work of the Department; it is designed to have a trailer.

The display by the Metropolitan-Vickers Electrical Co., Ltd., included a 7-9-cwt. capacity demonstration van which is suitable for the delivery of bread or milk; an 18-22-cwt. capacity chassis of standard design without bodywork so as to show details of construction; an 18-22-cwt. capacity box van and a demonstration controller and motor shown in operation.

Midland Vehicles, Ltd., showed a type BA12 chassis with a van-type body which has a capacity of 12 cwt., type B25 chassis without bodywork, and type B25 chassis similar to the above fitted with a lorry body with a capacity of 15 cwt.

A "Servitor" three-wheel chassis without bodywork, having a carrying capacity of 10 cwt. and specially designed for the delivery of milk and bread, was displayed by Murphy Cars & Trucks, Ltd., who also showed a complete vehicle.

Partridge, Wilson had on show a "Utility" combined passenger and goods vehicle suitable for commercial travellers, service engineers, and similar duties. It is suitable for two or three passengers, and has ample space for samples. The other exhibit by this company was a "Bulldog" chassis, without body, showing standardised construction. This vehicle has a capacity of 15 cwt. when provided with a normal body.

The battery exhibits consisted of simple cells, plates, and crates of standard traction-type batteries and also cut-away cells and plates by the following manufacturers: Chloride Electrical Storage Co., Ltd.; D.P. Battery Co., Ltd.; Tudor Accumulator, Ltd.; and Young Accumulator Co., Ltd. The Westinghouse Brake & Signal Co. exhibited its latest type standard vehicle charger suitable for a 30-cell battery.

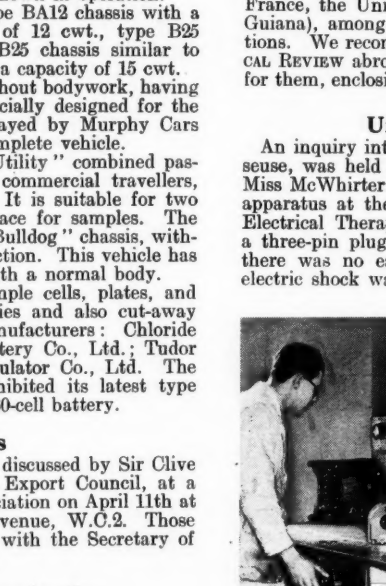
Export Groups

The subject of Export Groups will be discussed by Sir Clive Baillieu, an executive member of the Export Council, at a luncheon of the British Engineers' Association on April 11th at the Hotel Victoria, Northumberland Avenue, W.C.2. Those wishing to attend should communicate with the Secretary of the B.E.A., 32, Victoria Street, S.W.1.

Current-Transformer Production

Despite its small size and the fact that it has been in existence only four years, the firm of F. C. Smith & Co., 18-22, Kingston Hill, Kingston, Surrey, which specialises in the manufacture of current transformers, has already made about four thousand instruments and has established a considerable reputation for its products. All classes of instruments for metering and protective gear are produced, the nature of the company's business making it a simple matter to undertake any special designs required.

The standard units, however, include an enclosed compound-filled ring transformer, with sealable secondary terminals, made in three sizes for ratios 100-300/5, 300-800/5 and 1,000-1,500/5; a wound primary type with either a sealable terminal box or open terminals, made in various sizes, air or oil insulated, single or double secondary; and a "trombone" type with porcelain or bakelite insulators and single or double secondary. All these instruments can be supplied for a maximum pressure of 12 kV and can normally be built to any required accuracy up to Class AM. In the production of the wound primary instruments, use is made of an ingenious coil-forming device of Mr. Smith's own design. This gives an exceptionally robust construction as well as remarkable accuracy. The normal rating of these wound primary transformers is 150 times rated current for half a second, but if a larger rating is required, special designs can be supplied. All the transformers undergo full B.S.I. tests. The measurements of ratio and phase angle errors are carried out on a testing equipment of the same design as that which is in use at the National Physical Laboratory.



Testing an enclosed ring type current transformer by means of Arnold equipment at F. C. Smith & Co's works. Left: the sealing cork being fitted to an 11-kV voltage transformer

In addition to the instruments mentioned, special precision current transformers are also produced, and when we visited the factory recently we saw a multi-range unit with mumetal cores being made for the National Physical Laboratory. Potential transformers of all kinds and small power transformers of up to 10-kVA capacity are other specialities of the company.

Posting the "Review" Overseas

Printed matter destined for many countries can only be dispatched by holders of special permits. Empire countries, France, the United States and South America (except Dutch Guiana), among other countries are exempt from the regulations. We recommend readers who wish to send the ELECTRICAL REVIEW abroad to ask our Publishing Department to do it for them, enclosing the necessary amount to cover the postage.

Unearthed Three-pin Plug

An inquiry into the death of Miss Annie McWhirter, a masseuse, was held in Glasgow last week. It was reported that Miss McWhirter collapsed while switching on some diathermy apparatus at the Scottish Clinic and School of Massage and Electrical Therapy, Glasgow. A police engineer stated that a three-pin plug was fitted to the flex on the machine, but there was no earth wire. A verdict recording death from electric shock was returned.

Employment in February

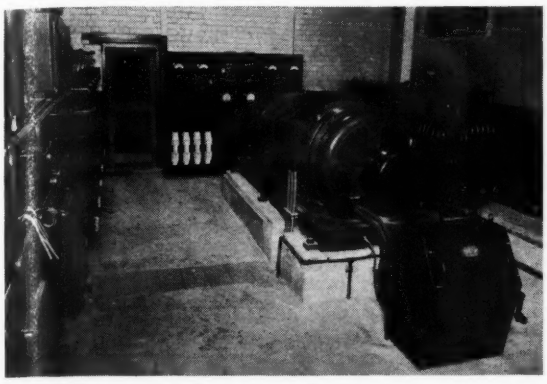
Employment in the engineering industry between January 15th and February 12th showed little change on the whole, and there was a slight decrease in the number unemployed in electrical engineering. According to the *Ministry of Labour Gazette*, the percentage unemployed in the engineering industry as a whole at February 12th was 3.3, the same as at January 15th, and comparing with 7.9 per cent. at February 13th, 1939. In electrical engineering the number of unemployed was 3,000, or 2.4 per cent., as compared with 2.3 per cent. in January and 5.5 per cent. in February, 1939. The number out of work in the electrical wiring and contracting industry was 3,616, the percentage of 8.4 showing an increase of 0.2 as compared with the previous month, but a decrease of 2.6 per cent., as compared with February, 1939. The unemployed in the electric cable, apparatus, lamps, &c., group totalled 8,609, the percentage being 4.6 as compared with 5 per cent. in January and 7.6 per cent. in February, 1939.

E.I.B.A. Benefactors

Substantial contributions have recently been received by the Electrical Industries Benevolent Association from the Cable Makers' Association (£210) and George Ellison, Ltd. (£100). In addition, a number of firms and individuals have acted upon the suggestion that special donations should be made to the funds to compensate for the loss resulting from the cancellation of the annual ball. A list which we have received records a total of £183 contributed in this way.

A Works Change-over

On account of an increasing demand for hydraulic presses and oil engines, Fielding & Platt, Ltd., decided last summer to extend their factory at Gloucester. Electricity was previously obtained from a DC reciprocating set and from the AC medium-voltage mains, but the whole supply is now taken at 10,500 V from the Corporation. The high-voltage switchgear is of the vertical isolation metal-clad air-insulated type for 150 MVA, and is associated with extensible ring-main oil-break



General view of the installation at the factory of Fielding & Platt

isolators. Two 350-kVA three-phase indoor ON transformers with 2½ and 5 per cent. h.v. taps step down to 400-230 V. Medium-voltage AC switchgear is of the sheet-steel cubicle pattern incorporating oil circuit-breakers and gang-operated isolators.

A 200-kV 110-V DC protected-type generator driven by a 300-HP screen-protected slip-ring motor with liquid starter has been installed to serve the existing motors through a DC switchboard, which also includes two feeder circuits.

The whole of the above apparatus was supplied and erected by the main contractors, the Brush Electrical Engineering Co., Ltd. An iron-clad AC distribution board was supplied by H. Holmes & Co. and the interconnecting cables for the plant were installed by the West Gloucester Power Co.

Brush Company's Students

The Brush Electrical Engineering Co., Ltd., is frequently approached by old students who served their time with either the company or its associated company, Petters, Ltd., with regard to the preparation of a students' register. The company has a register of Petter students which is not up-to-date, and also addresses of many old Brush students, but the information is incomplete. It therefore asks all ex-Brush and Petter pupils, students or apprentices to communicate with it. It is the company's future policy to keep in touch with all pupils, students and apprentices who have served their time in the works of the Brush Electrical Engineering Co., Ltd., and of Petters, Ltd., and send them, from time to time, news of the companies concerned.

Brighton and Whitley Councils

A proposal put forward by the chairman of the Finance Committee (Ald. Galliers), that the Brighton Town Council should withdraw from all Joint Industrial Councils and Whitley Councils with which it is connected, was rejected by the Council at a recent meeting. Alderman Galliers said that the rate of 10s. 2d. fixed made very little allowance for contingencies, and any wage increases approved by the J.I.C.s, which did not require the confirmation of the Council, would result in a deficit.

"Nylon" Insulation

An official announcement concerning the manufacture in Great Britain of the new substance known as "Nylon" has been issued by Imperial Chemical Industries, Ltd., together with a concise summary of its main features and properties, some of which are unlike any of those of other fibres from which textile-like materials are made. The material is a synthetic substance without any cellulose base. Vegetable oil as well as minerals may enter into the manufacture of "Nylon," one promising type of which can be made from a dibasic acid and a diamine, both derived from phenol, which is commonly prepared from bituminous coal. Making a dibasic acid needs oxygen from the air; for the diamine ammonia is needed, made synthetically by causing hydrogen from water to unite with nitrogen from the air.

"Nylon" can be produced in extremely fine filaments from which yarns can be spun; also as bristles, sheets and rods. The fabric itself will not ignite, but melt without catching fire; films can be made quite transparent. One type, when dry, is a very good insulator and resists abrasion. Electrical insulation experiments are now being made with wires encased in a continuous film which is applied when the "Nylon" polymer is in a molten state. So tough is this sheath declared to be that copper wire is said to break before the coating cracks.

Production of the new material commenced in the U.S.A. as the result of research conducted by the E. I. du Pont de Nemours organisation. Three factories are now being built in England. One of them, which will produce the raw polymer, is being erected at Huddersfield by the I.C.I. Dyestuff Group. The other two, both of which will convert the raw material into the intermediate monofil and yarn for sale to their respective industries, are at the works of I.C.I. (Plastics), Ltd., Welwyn Garden City, and at British Nylon Spinners, Ltd., a joint company formed by Imperial Chemical Industries, Ltd., and Courtaulds, Ltd., whose factory will be at Coventry.

Vitreous Enamellers' Exhibition

An exhibition of vitreous enamelled ware and testing appliances will be held in the Charing Cross Hotel, Strand, W.C.2, to-morrow (Saturday), by the South Section of the Institute of Vitreous Enamellers, commencing at 2 p.m. The exhibition will be opened by Mr. G. A. Abbott (National Enamels, Ltd.), chairman of the section, and guests will be welcomed by Mr. H. M. Hibberd (Belling & Co., Ltd.). A lecture will be given during the afternoon by Mr. W. E. Charles (Blythe Colour Works, Ltd.), on "Enamelling on Bronze, Gilding Metals, Silver, Silver Deposits, and Gold."

Southampton's Subscriptions

The Southampton Town Council has had under review the amounts of annual subscriptions which it pays to various associations. It has been decided to contribute half of the normal amount of £386 to the British Electrical Development Association and to discontinue the subscription (£13) to the Union Internationale des Tramways. On the other hand, the amount subscribed to the funds of the British Electrical and Allied Research Association (£50) is to be continued.

Calendar

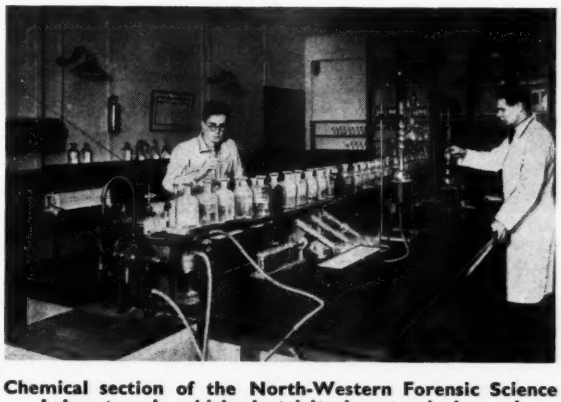
The series of "girl" calendars which the Metropolitan-Vickers Electrical Co., Ltd., has now been issuing for some years past is being continued in spite of the war, and the London girl who adorns the 1940-41 calendar which we have just received is a typical English beauty who worthily takes her place with her predecessors.

Census of Industry

Owners of engineering and certain classes of constructional factories have been ordered to make a return to the Ministry of Supply by April 10th giving particulars of the labour employed and of production. It is proposed to call for similar returns at quarterly intervals.

A Forensic Science Laboratory

Electrical equipment is extensively used at the new North-Western Forensic Science Laboratory at the Lancashire county police headquarters by the staff of qualified chemists, physicists, biologists and photographers, the majority of the scientific instruments employed requiring electricity for their operation. These include the photomicrograph, which makes a photo-



Chemical section of the North-Western Forensic Science Laboratory in which electricity is extensively used

graphic record of hair and other minute fibres, and an instrument which can detect the presence of arsenic in human organs.

All power plugs are mounted either on or just under the benches in such a way that the instruments may be easily coupled up. The three-phase 400-V supply from Preston Corporation is split up to the various departments so that the voltage in any one room is not more than 230 (if phase A and neutral are used for lighting in one department, the same phase and neutral would be used for the power plugs in that room). Callender cable was used throughout the installation. The

spectographic laboratory houses a rotary convertor set to provide DC for the arc lamps. Direct current is also used for other purposes, and extensions have been taken to the main chemical and the micro-chemical departments, a DC supply being available at any voltage from 200 down to 12.

Connected to the bell system there is a six-way movable bell push on the director's desk, with each department on the system. Lighting points number 63, and there are sixteen 2-A, twenty-one 5-A and fifteen 15-A socket outlets. Heavy gauge tube used totalled 2,700 ft., and the amount of Callender's v.i.r. (C.M.A. grade) cable in various sizes was over 3,000 yd. The electrical contractors were Hough & Kearton, of Preston and Leigh.

Rating of Grid Equipment

The reserved judgment of a Divisional Court was delivered this week by Mr. Justice Hilbery in the appeal of the Barking Rating Authority on a special case stated by Essex Quarter Sessions. The respondents were the Central Electricity Board. The Judge said that the substantial question was whether the Essex Quarter Sessions were right in law in holding themselves bound to arrive at the rateable value of the Board's transformer substation at Barking, transmission line towers, &c., on the "profits basis."

The appellants' counsel maintained that this basis would be right were it not that special circumstances existed which made it necessary to exclude this recognised formula of assessment. The Quarter Sessions ruled that there were no special circumstances and the Divisional Court upheld that decision.

Another question was whether evidence relating to respondents' estimates and accounts subsequent to 1934 was rightly excluded. The Divisional Court was of the opinion that the Quarter Sessions were right in paying regard to the last accounts before the date of the assessment and would not have been right in looking at subsequent accounts.

The appeal was therefore dismissed with costs, but the Rating Authority was given leave to appeal further.

Public Service Transport Association

The Minister of Transport will be the principal guest at the congress luncheon of the Public Service Transport Association to be held on May 2nd.

Plastics Year Book

Restrictions on paper have made it necessary to limit the number of pages in the "British Plastics Year Book, 1940" (Plastics Press, Ltd., 19-23, Ludgate Hill, London, E.C.4, 15s. net), but, nevertheless, the publication remains a valuable handbook and guide to the plastics industry. The editorial section of the present edition includes a brief résumé of the use of plastics in wartime which, with a review of the plastics industry, gives a comprehensive survey of the progress of the industry. In the address section the regular addresses of firms are given together with their temporary addresses, where known. All the other sections of the directory which have appeared in previous editions have been brought up to date.

Apparatus Approval in Canada

Commencing on May 1st it is expected that purchasers of electrical equipment throughout Canada will be provided with a guarantee of quality and safety in the form of a stamp of approval of the Canadian Standards Association on such goods. This announcement was made after a recent meeting of the Executive Committee of the Association in Montreal, which was called primarily to discuss the proposed assumption by the Association of the responsibility for the approval of all electrical equipment to be sold in Canada. The object is the reduction of fire and accident hazards.

In the proposed procedure every type of electrical apparatus, industrial and domestic, will be submitted to the Association prior to installation or distribution in Canada. Each will be tested by a laboratory appointed for the purpose by the Association, and if it conforms to the requirements of the standard specifications it will be labelled with an approval seal. Representatives of the Association will follow up the tests with inspections at the place of manufacture to assure that the equipment is being constructed for distribution according to details of the approved sample.

At a meeting of the Executive Committee the appointment of an administrative board was authorised. The board consists of Messrs. W. P. Dobson, Hydro-Electric Power Commission of Ontario (chairman); B. G. Ballard, National Research Council; W. E. Ross, Canadian Manufacturers' Association; and Col. W. R. McCaffrey, C.E.S.A. secretary. The administrative offices will be in the National Research Building, Ottawa.

New Hawarden Showrooms

The new electricity showrooms of the Hawarden Rural District Council at Shotton were recently opened by the chairman of the Council, Mr. Scholey, who said that the electrification of rural areas was no easy matter, but he believed that only an intensification of the electrical system would make agriculture a first-rate industry in this country. He paid tribute to the co-operation of the North Wales Power Co., from whom the bulk supply is purchased, and a representative of that company, Mr. T. R. Smith, said that next year, because of the terms on which the Council bought electricity from the company, there would actually be £2,500 towards the relief of the rates. Mr. J. Irving, chairman of the Electricity Committee, gave some figures showing the growth of the undertaking. The new building has a frontage on the ground floor of 31 ft., and at the rear there is an up-to-date meter testing room and store rooms. The showroom is on the second floor of the main building, which also houses the administrative departments. The electrical engineer to the Council is Mr. A. J. Richardson.

Greek Import Restrictions

By a Greek decree of February 26th, certain classes of goods, provided they were ordered from abroad before September 9th, 1939, may be imported under licence. The list includes incandescent electric lamps, instruments and apparatus for applied electricity, batteries and accumulators, and "parts for electricity." The first and last of these can only be imported from countries which have trade agreements with Greece or with which Greece has an active balance of trade.

Iranian Import Quotas

The Government of Iran has fixed import quotas for the current year. The value of electrical material which may be imported has been placed at 9 million rials (80 rials=£1 at par).

Motor Service

For the assistance of buyers who need motors in the shortest possible time, Bull Motors has commenced the publication of a periodical bulletin giving full particulars and prices of standard A.C. motors available from stock, and details of new developments and service facilities.

Coal Utilisation Joint Council

The address of the head office and southern branch of the Coal Utilisation Joint Council is now General Buildings, 99, Aldwych, London, W.C.2 (telephone: Holborn 3326; telegrams: Promocoal, Estrand, London).

Prices of Materials

Henry Gardner & Co., Ltd., report, April 3rd: No change in the price of copper bars (best selected), sheet and rod, English pig lead, spelter and mercury. English block tin £248 15s., £1 10s. increase.

No changes in the prices of materials were reported on April 3rd by Edward Till & Co. (india-rubber, Para fine), and F. Smith & Co. (electrolytic copper bars, wire rods and h.c. wire).

New Catalogues and Lists

Sloan Electrical Co., Ltd., 54-55, Fetter Lane, London, E.C.4.—A leaflet dealing with the "Slonetric" ultra-violet lighting unit.

Heala (Electro-Medical), Ltd., 33, New Cavendish Street, London, W.1.—A booklet describing the applications of the "Heala" ray for infra-red ray treatment.

Crofts (Engineers), Ltd., Thornbury, Bradford.—Catalogue S140 consisting of 540 pages of standard power transmission appliances and complete belt, rope, V-rope, chain and gear drives.

Londex, Ltd., Anerley Works, 207, Anerley Road, London, S.E.20.—List No. 87 illustrating and describing new double-action relays LF/double and LQA/double.

Santon, Ltd., Somerton Works, Newport, Mon.—A well-produced brochure relating to the Santon rotary switch. Although technical in its text, it is couched in terms sufficiently simple to be understood by the semi-technical user. A number of actual photographs of apparatus are included.

International Refrigerator Co., Ltd., 1-3, Brixton Road, London, S.W.9.—A booklet describing hermetically sealed unit refrigerators. Also a folder illustrating the company's standard range of domestic refrigerators for the coming season.

W. C. Davey & Co., Telephone House, 176, Tottenham Court Road, London, W.1.—Publication 124 containing illustrated particulars of "Sterdy" luminous signals for office use.

Belling & Co., Ltd., Bridge Works, Southbury Road, Enfield, Middlesex.—A leaflet relating to the "Belling" electric bed warmer, showing the actual colours which are available, and a leaflet giving particulars of the company's "Champion" heaters.

Marconiphone Co., Ltd., 100, Blyth Road, Hayes, Middlesex.—Illustrated technical details of two more radio receiving sets of the 1940-41 range. No. 893, which supersedes No. 879, is designed to suit the good-class DC/AC market, and No. 892, which succeeds No. 872, is a new four-valve superhet battery receiver.

Information Department

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, &c., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

LITTLE WIZARD aerator.
DYMAX compressor.
VITER A.R.P. lamp.
Address of CARR & Co., makers of DUSTFLOW vacuum cleaner.

ELECTRICITY SUPPLY

Secretary of State's Ruling on Dundee Payments. Safeguarding Supplies at Manchester. Cost of Air-raid Shelter Installations at Southend.

Bath.—GRATEFUL FOR RATE RELIEF.—In presenting the city "budget" recently, Councillor J. Plowman said that once more the Electricity Committee had granted them £5,000 from the undertaking's profits, for which they offered grateful thanks, but the possibility of this relief continuing during the war period was remote.

Blackburn.—AMALGAMATION PROPOSAL.—A proposal to amalgamate the sales and showroom organisations of the Corporation Gas and Electricity Departments was to be moved by Councillor R. F. Mottershead, leader of the Town Council, at yesterday's Council meeting. Joint reading of gas and electricity meters and a system of continuous billing are also suggested. A standing committee of thirteen would be appointed to control the proposed joint organisation, the functions and personnel to be settled by a sub-committee consisting of the chairman and vice-chairman of the Gas, Electricity, Finance, and Gas and Electricity Joint Sales Committees.

SUBSTATIONS.—The Finance Committee is applying to the Electricity Commissioners for sanction to borrow £11,148 for expenditure on substations at Samlesbury and at Record and Harley Street Mills, Great Harwood.

Brighton.—ELECTRICITY FOR CANTEENS.—At its last week's meeting the Council rejected a recommendation of the Education Committee that gas cooking and heating equipment should be installed at the Whitehawk and Moulscombe canteens and decided to provide electrical equipment for the purpose. The chairman of the Electricity Committee assured the Council that the cost would be lower.

Cheltenham.—PROPOSED OVERHEAD LINE.—The Electricity Committee has obtained permission for the erection of an overhead line to Haydon.

Darlington.—ALTERATION OF SUPPLY.—The Town Council has applied to the Electricity Commissioners for sanction to borrow £16,450 for changing the supply in the Cleveland Terrace area from single-phase to three-phase.

Dover.—ENGINEER'S SALARY.—At a recent meeting of the Dover Electricity Committee the salary of the borough electrical engineer (Mr. R. G. Widgery) was discussed. The salary is raised by increments for each additional half a million kWh sold and a member of the Committee considered that the increases should be based on profits, not sales. It was pointed out that as the undertaking was not primarily a profit-making concern this would be most unfair to the engineer. It was also stated that since November, 1937, the increase in Mr. Widgery's salary had been about £100.

ACCOUNTS AND CHARGES.—At the same meeting it was reported that the estimated surplus for the year ending March 31st was £7,410 and that for 1940-41 £4,604. The engineer recommended that prices should not be reduced in view of the uncertainties but that the 1939-40 surplus should be placed to reserve. A resolution providing for the reduction of the lighting flat rate by ½d. per kWh as from the first meter reading after April 1st was carried, and it was agreed that other charges should be maintained at the present level.

Dundee.—ILLEGAL PAYMENTS.—The Lord Provost's Committee on March 28th considered the final determination of the Secretary of State declaring certain items in the accounts illegal. These items, to which attention had been drawn by the city auditor, included payments for councillors' telephones and payments to certain Corporation tenants who had installed electricity at their own expense. The Secretary of State abstained from making a surcharge. The Committee agreed to accept the determination.

Egham.—POSITION UNDER STREET LIGHTING AGREEMENTS.—The Council has informed the Egham & Staines Electricity Co. that it is advised that while public lighting continues to be restricted the Council is not liable under existing agreements. Without prejudice to its position, however, it has offered to meet representatives of the Company to discuss the matter. Meanwhile the Company has offered to maintain the lamps at the following minimum prices: Mercury electric-discharge, £6 1s. per lamp per annum; gas-filled, 15s. per lamp. These charges are offered without prejudice to the existing agreements between the Council and the Company.

Fraserburgh.—STREET LIGHTING CHARGES.—At its last meeting the Town Council decided to await the decision of the Convention of Burghs in regard to street lighting before taking action on its own behalf. The Council has received an account from the Grampian Electricity Supply Co. amounting to £224 for the last four months of 1939, although no electricity was used in that period. The town clerk stated that some local authority would probably have to fight a test case, in which event he thought that other authorities with similar agreements would be willing to help.

Glasgow.—PRESENT CHARGES TO BE MAINTAINED.—It was indicated at a meeting of the Electricity Committee last week that during the next six months there would be no increases in electricity charges in the city. The Department, it was stated, had been carrying out during the past few years a policy of accelerated reduction of the loan debt, and notwithstanding the increased costs due to the war, it was decided to make a special payment of £33,000 for the purpose of reducing the debt.

STREET LIGHTING DURING FOG.—The Ministry of Home Security has informed the Corporation that while there would be no objection to the use of ordinary street lighting in case of fog in the day time, such lighting at night during fog could not be permitted on account of the risk involved.

Grangemouth.—COMPANY'S CONCESSION.—Recently the Council wrote to the Scottish Central Electric Power Co. complaining that it had been too harsh in its treatment of wives of serving soldiers who had been unable to pay their electricity charges. In one case brought to the notice of the Council it was stated that the Company had refused to reconnect a consumer unless she paid a deposit of £3, plus a connection fee of 5s. The Company has now informed the Council that in view of the representations made it has decided that in the case of consumers able to prove war hardship the deposit required after disconnection for non-payment of accounts will be waived; this would apply only for the first disconnection of any consumer. The Company states that it is unable to waive or reduce the connection fee of 5s., which does not cover the expense incurred.

Hornsey.—STAFF REDUCTION.—It was recently reported to the Town Council that owing to the closing down of capital works the Electricity Committee found that it was unfortunately necessary to reduce the personnel employed. The staff generally had been reviewed and twenty-eight members would be dismissed, which would result in a saving of about £4,600 a year.

Houghton-le-Spring.—REDUCED TERMS.—The Urban District Council has received an offer from the North-Eastern Electric Supply Co., Ltd., to reduce the charge for street lighting as from January 1st last from 50 to 25 per cent. of the normal charges, subject to the Council agreeing to the continuation of the existing agreement with the company for a period after the normal resumption of street lighting equal to that during which the reduction has been in force. The Council is waiting until a report is received from the Urban District Councils' Association before it makes a decision.

Lancashire.—RENEWAL OF ELECTRICAL INSTALLATION.—The County Council is to rewire the electrical installation in the Darwen Technical School, and is applying for permission to borrow £1,500 for this purpose.

London.—BERMONDSEY.—The Electricity Committee has had under consideration the income from the hire of electric cookers, and reports that under present charges a considerable loss is shown. The existing rentals are 4d. to 6d. a week, and it is now proposed to alter charges as follows:—Standard size cooker, 9d. a week; large size, 11d. Wiring for cooker, if required, 3d. per week. These charges will be for 10 years, after which the cookers will become the property of the consumers.

Manchester.—TRANSMISSION SCHEME.—The Electricity Committee has recommended the City Council to apply to the Electricity Commissioners for sanction to borrow £55,000 for a 33-kV main transmission cable from Barton generating station to Benchill substation, and £10,000 for switchgear to control this feeder. Mr. H. C. Lamb, chief engineer and manager, reports that the load in the area comprising Wythenshawe, other portions of South Manchester, and the Sale and Cheadle undertakings has risen appreciably since the winter of 1938-39. In the event of breakdown during the winter months of any one of the three 33-kV feeders which provide the supply to this area there would be serious overloading of the remaining feeders. He advises that a new 0.3 "H" type feeder should be laid from Barton generating station through a spare earthenware pipe to Benchill substation. This will provide an effective means of safeguarding existing supplies and will enable future demands in the above areas to be met.

Southend-on-Sea.—CONTRACT RATES RESTORED.—In December last the Council authorised a number of tariff alterations including the withdrawal, as from the second quarter of the current calendar year, of all contract rates for electric lighting, except on the lower demands of 115, 138 and 184 W. Last week Councillor J. E. Longman moved that this particular decision should be rescinded. He said he had spoken to 37 of the consumers affected (who number over 2,000) and everyone was disgruntled. He thought the real reason was that the Electricity Committee wanted to get more appliances in the homes. Alderman Johnson (chairman of the Committee) said it was considered that the system was out of date. Many people who had been persuaded to leave the contract rate had since admitted that they were glad they had done so. Councillor Longman's motion was carried by 23 votes to 13.

INSTALLATIONS IN AIR-RAID SHELTERS.—It was reported that after a meeting with local electrical contractors the prices quoted for installations in air-raid shelters in schools had been reduced, and on a time and material basis the average cost

per shelter would be about £6 10s. About 80 shelters were involved. Councillor Tyler, moved the reference back of the recommendation, but it was pointed out that the work had been practically completed. Remarking that he would have to be content with lodging a protest, Councillor Tyler said that the original quotation from all except one contractor was £8 8s., the exception being £6 10s. When inquiries were made the others found that they could all do it for £6 10s. Somewhere about £120 was being spent more than it would have cost the Department if it had done the work. In normal times the Department gave the contractors £1,400 more than it would cost the Department to do domestic wiring. It was high time that the Council revised the policy of giving work at enhanced prices to contractors.

REPAIRS TO DIESEL ENGINE.—A recommendation that a new crankshaft should be fitted to the Diesel engine at the electricity works at a cost of £1,875 was approved after a motion for the reference back of the proposal had been defeated.

HIGH MAXIMUM DEMAND.—The electrical engineer has reported that in consequence of the heavy demand for electricity during the cold weather the maximum demand on the undertaking has been increased by more than 2,000 kW, involving additional fixed charges on bulk supply of approximately £6,000.

Southport.—SUBSTATION SWITCHGEAR.—The Electricity Committee has decided to replace switchgear in six substations at an estimated cost of £2,250.

West Ham.—RATE CONTRIBUTION.—Estimates on which the borough rates for the next half-year are based include a contribution of £9,000 from the electricity undertaking.

West Riding.—TRAINING COLLEGE INSTALLATIONS.—The County Council has approved a recommendation for the installation of electricity at the Bingley Training College at an estimated cost of £4,300.

York.—LOAN FOR POWER STATION EXTENSION.—The City Council has received permission to borrow £178,397 for the extension of the Foss Islands generating station. Loan sanction has also been obtained for £4,000 (consumers' electrical apparatus) and £4,780 (cable to Rowntree's works).

RADIO & TELEPHONY

Great Britain.—CRITICISM OF RATE CONTRIBUTIONS.—A decision by Hull City Council that the Telephones Department should contribute £5,000 to rate relief was reported to a meeting of the Telephones Committee last week. The Committee itself was not consulted. Remarking that the Transport Department was now suffering "because of this ridiculous procedure of giving money from its reserves to the relief of the rates," Councillor Jacobs said he wondered how long it would be before they would find themselves in exactly the same position. The Transport Department had had to put up its fares because in the past it had given nearly £250,000 in this way. A good many people were going to be faced with an increase of nearly £10 a year for going backwards and forwards to work and were saving only 11s. in rates.

POLICE TELEPHONE SYSTEM.—The Cumberland County Standing Joint Committee is considering a plan for the linking of all police offices in Cumberland, Westmorland and Lancashire with private telephone lines. The cost would be £1,099 per annum.

Indo-China.—TELEPHONY.—There were 151 telephone exchanges in operation in French Indo-China at the end of 1938, of which only three were automatically operated. Out of a total population of the country of over 23 millions there were only 9,084 subscribers to the telephone system, an increase of 1,025 during the year.

Switzerland.—NEW TELEPHONE LINK.—According to the *Journal des Télécommunications* a telephone service has recently been established between Berne, Switzerland, and Trieste, Italy.

TRANSPORT

Bolton.—TRAMS RETURN.—On Monday trams were brought back on the Halliwell and Smithhills Hall route from which they were withdrawn in favour of motor-buses shortly before the outbreak of war. The step has been taken to help in conserving fuel oil supplies.

Brighton.—CORPORATION TAKES OVER ELECTRIC RAILWAY.—Volk's Electric Railway was taken over by the Corporation Transport Department last Monday, Mr. M. H. Volk (managing director) formally handing over the charts and plans of the railway to Councillor E. Simms (chairman of the Transport Committee). Opened in August, 1883, by the late Mr. Magnus Volk, it was the first public electric railway to be operated in this country.

Eire.—DUBLIN-LUCAN TRAMWAY.—It is intimated that the tramway line between Dublin and Lucan is to be removed in the near future and the road restored in negotiation with Dublin United Tramways Co.

London.—RECONSTRUCTION OF SLOANE SQUARE STATION.—On Wednesday last week the first stage of the reconstruction of Sloane Square Underground Railway station was completed when "up" escalators of the Waygood-Otis type from the platform to the street and a new ticket hall were opened to the public. These are the first escalators to be built by the London Passenger Transport Board in an open station. They are 50 ft. long and rise 25 ft., sparing passengers a climb of 71 steps. There was no room to build "down escalators," but new steps have been built in easy stages. Sloane Square, which is used by some 150,000 passengers a week, is one of the oldest stations on the Board's railways. It was opened on December 24th, 1868, and it had remained in its original condition until the present reconstruction was begun. The new station will be finished at the end of July. The Board now has 160 escalators, the greatest number owned by any one undertaking in the world.

NEW "UNDERGROUND" ROUTE.—The new service of Underground trains over the electrified L.N.E.R. tracks will begin operating beyond East Finchley to High Barnet on Sunday, April 14th.

Mersey Railway.—ELECTRIC LIFTS.—Two electric lifts are to be installed at James Street Station, Liverpool, to replace a hydraulic lift in which 60 people were injured last January when it fell from the booking office level to the station level 80 ft. below.

Electricity Price Increases

AS from the March quarter meter readings the Aldeburgh Electric Supply Co., Ltd., is adding 5 per cent. to the total amount of consumers' accounts.

Ashford (Kent) U.D.C. is adding 10 per cent. to all unit charges except in the case of the domestic two-part tariff, which is subject to special revision, consumers covered by a coal clause, and prepayment consumers where the whole supply is chargeable at 10d. or 8d. per kWh.

Charges at Bedford are to be increased by 10 per cent. from the June quarter meter readings.

At Brentford and Chiswick charges are being raised by 15 per cent. as from the March quarter meter readings. All charges except the prepayment meter rate of 5d. per kWh are affected.

Bridgend Urban District Council is raising its electricity charges by 12½ per cent.

Brierfield U.D.C. is making an all-round increase of 17 per cent.

Bridlington Electricity Committee proposes to raise the lighting flat rate from 3½d. to 4½d. per kWh and the two-part tariff running charge from ½d. to ¾d.

In view of the estimated deficit of £10,702 for 1940-41, Brighton Electricity Committee proposes to withdraw the three-units-a-penny summer rate under the two-part tariff and impose a general increase of 10 per cent. on all charges.

At Clacton the "unit" charge under the domestic tariff is being raised from ½d. to ¾d.

Douglas Electricity Committee has advanced the price of electricity for lighting between midnight and sunset, under the two-rate system, from 2½d. to 3d. On the flat rate, the charge is increased by ½d. to 6½d. per kWh for the first 2,000 kWh per annum; thereafter the price is 5½d. The discount for prompt payment is halved.

Owing to the higher cost of coal Gravesend Electricity Department is to increase its charges as follows—Domestic rate: summer "unit" charge ¼d. instead of ¼d., winter charge unaltered; annual fixed charge increased by 2½ per cent. of rateable value, making it 12½ per cent. Fixed rate charge: total amount increased by 5 per cent. Two-rate tariff: off-peak "unit" charge raised from 1¼d. to 1¾d. (AC) and from 1¾d. to 2d. (DC).

Faversham Town Council last week decided to add 12½ per cent. to all electricity charges and abolish the 5 per cent. discount for quarterly accounts for lighting and power supplied on flat rates.

A recommendation that the electricity charges should be increased by 12½ per cent. was recently approved by Heckmondwike Council.

A previous decision by Hove Town Council to increase the summer "unit" charge under the domestic and business all-in tariffs from ¼d. to ½d. has been rescinded. Instead, there is to be a general 10 per cent. advance.

Lichfield City Council has approved a 10 per cent. increase in the charges for electricity as from April 1st.

At Loughborough (Leics.) electricity charges are being raised by an amount equal to 5 per cent.

At Rawtenstall the Electricity Committee considered a 5 per cent. advance advisable, but it has eventually been decided to halve the discount instead of raising prices.

Walton and Weybridge U.D.C. is increasing the lighting flat rate from 4½d. to 5d. per kWh as from the end of June next. The cooking and heating rate will be raised from 1d. to 1¼d. and the domestic tariff charges are also to be revised.

Willesden Electricity Department announces an advance of 10 per cent., excluding hire charges, meter rents and minimum quarterly charges.

At Wrexham there is to be an increase of approximately 10 per cent.

NEW PATENTS

Electrical Specifications Recently Published

Compiled by a firm of chartered patent agents. The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1938

15784. "Method of electron control." G. Jobst. May 26th, 1937. (Cognate applications 15785/6/7/8/38.) (518665.)

16696. "Telephone systems." S. Ballantine. June 3rd, 1938. (518814.)

16697/16698. "Throat microphones." S. Ballantine. June 3rd, 1938. (518815/518816.)

18092. "Electrolytic deposition of zinc dust." Siemens & Halske Akt. Ges. June 18th, 1937. (Addition to 515156.) (518865.)

19311. "Course-deviation indicating devices." Sperry Gyroscope Co., Inc. July 31st, 1937. (Addition to 475097.) (518817.)

19652. "Rectifier arrangements." R. A. Nind and P. A. T. Bevan. July 2nd, 1938. (518713.)

19672. "Directional radio systems." Bendix Aviation Corporation. July 2nd, 1937. (518714.)

22870. "Electric signal transmission systems." F. W. Cackett. August 2nd, 1938. (518672.)

23292. "Impulse generators and thermionic tubes for use therein." Marconi's Wireless Telegraph Co., Ltd. September 30th, 1937. (518824.)

24738. "Electrical switch sockets." J. A. Crabtree & Co., Ltd., H. F. McLoughlin and B. G. Harrison. August 23rd, 1938. (518764.)

24739. "Electrical interlocking switch-sockets." J. A. Crabtree & Co., Ltd., H. F. McLoughlin and B. G. Harrison. August 23rd. 1938. (518765.)

24903/24909. "Rubber-like compositions." W. T. Henley's Telegraph Works Co., Ltd., H. A. Tunstall and B. B. Evans. August 24th, 1938. (518718/518719.)

24972. "Electric-discharge devices." Ferranti, Ltd., A. L. Chilcot and S. Jackson. August 25th, 1938. (518766.)

25188. "Impulse senders of the type used in telephone systems." General Electric Co., Ltd., and C. C. Puckette. August 27th, 1938. (518721.)

25195. "Searchlights or like light projectors." J. H. Laybourne. August 27th, 1938. (518674.)

25270. "Plug-and-socket type electrical connections." Switchgear & Cowans, Ltd., and A. Upton. August 29th, 1938. (518723.)

25316. "Electrical measuring instruments." F. C. Ellis. August 29th, 1938. (518728.)

25320. "Electric motor control systems." A. Rudman and Metropolitan-Vickers Electrical Co., Ltd. August 29th, 1938. (518729.)

25354. "Means for demonstrating control operations in electrical and other flow circuits." E. W. Jackson. August 30th, 1938. (518731.)

25372. "Mercury arc rectifiers." General Electric Co., Ltd., M. Pirani and D. G. Prinz. August 30th, 1938. (518732.)

25473. "Electrolytic devices." British Insulated Cables, Ltd., H. Higham and J. C. Quayle. August 30th, 1938. (518733.)

25383. "Electric totalisators." Siemens Bros. and Co., Ltd., and J. H. Broome. August 30th, 1938. (518677.)

25408. "Magnetic structures." Sangamo Weston, Ltd. October 9th, 1937. (518825.)

25417. "Push-button switches." M. Ersing and A. Woerner (trading as Kautt and Bux). September 29th, 1937. (518739.)

25421. "Fading regulation in television receivers." Radioaktges. D. S. Loewe. August 30th, 1937 (Addition to 464492). (518740.)

25426. "Control apparatus for railway installations." General Railway Signal Co. October 16th, 1937. (518768.)

25427. "Traffic-controlling systems for railways." General Railway Signal Co. December 18th, 1937. (518769.)

25479. "Electric fires." Bratt Colbran, Ltd., R. H. Masterman and E. C. Bratt. August 31st, 1938. (518744.)

25493. "Aerial and earth system for radio and television transmitting and reception apparatus." A. B. Hewett and A. G. Head. August 31st, 1938. (518684.)

25550. "Electrical switches, particularly applicable to switches of the tumbler or lever-operated type." A. C. Wynne. September 1st, 1938. (518770.)

25554. "Contactors for electrical switchgear." H. B. Prentice and J. G. Fielding. September 1st, 1938. (518772.)

25767. "High-pressure metal-vapour electric discharge lamps." General Electric Co., Ltd., V. J. Francis, E. Kettlewell and K. G. Schnetzler. September 2nd, 1938. (Cognate application 1891-39.) (518782.)

25775 "Electric gas-discharge relay circuit arrangements." Marconi's Wireless Telegraph Co., Ltd., and D. A. Bell. September 2nd, 1938. (518689.)

25777. "High-frequency alternating current heating arrangements." Patentverwertung Ges. Hermes. September 2nd, 1937. (518691.)

25828. "Electric meter constructions." Sangamo Weston, Ltd. (Sangamo Electric Co.). September 3rd, 1938. (518786.)

25880. "Carton or wrapper for electric lamps and other articles." C. N. Barton. September 5th, 1938. (518828.)

25932. "Radio aerials." Marconi's Wireless Telegraph Co., Ltd., O. Bohm and N. Wells. September 5th, 1938. (518829.)

25942. "Selective responsing devices for use in electric control systems." Automatic Telephone and Electric Co., Ltd., and J. F. Mackenzie. September 5th, 1938. (518877.)

26036. "System for determining the altitude of an aircraft in flight utilising electro-magnetic waves radiated from a pair of radio transmitters. J. H. Hammon, junr. September 16th, 1937. (518881.)

26051. "Telephone systems." Standard Telephones and Cables, Ltd., and G. C. Hartley. September 6th, 1938. (518883.)

26062. "Light reflectors." British Thomson-Houston Co., Ltd., and R. Maxted. September 6th, 1938 (Addition to 491012.) (518885.)

26083. "Combined motor mechanism and electric control switch therefor." National Pneumatic Co. September 30th, 1937. (518888.)

26093. "Automatic control arrangements for aeroplanes." J. T. Shelvin and Siemens Apparate und Maschinen Ges. September 6th, 1938. (518799.)

26108. "Remote control of radio receivers." E. K. Cole, Ltd., and A. Herczeg. September 7th, 1938. (518890.)

26129. "Alternating electric current generators." J. Lucas, Ltd., and E. A. Watson. September 7th, 1938. (518891.)

26195. "Thermionic valves." Telefunken Ges. für Drahtlose Telegraphie. September 7th, 1937. (518898.)

26272. "Gyroscope navigational instruments." Siemens Apparate und Maschinen Ges. September 8th, 1937. (518846.)

26340. "Telephone sets." Ericsson Telephones, Ltd., G. R. Newell and F. Hollis. September 9th, 1938. (518847.)

26384. "Method of and means for giving indication on board a vehicle moving along a guiding path, navigational data, and utilising a single radio transmitter." Standard Telephones and Cables, Ltd. October 6th, 1937. (518850.)

26815. "Motion-picture theatres, and methods of projecting pictures and producing sound effects therein." F. Waller and R. Walker. September 14th, 1937. (518905.)

26958. "Electric water heaters." British Thomson-Houston Co., Ltd., H. Fildes and L. A. Hackett. September 15th, 1938. (518907.)

32238. "Apparatus for producing for medical purposes, ultra-violet rays, the therapeutic effect of which can be smoothly varied." F. Kornmann. November 7th, 1938. (Convention date not granted.) (518701.)

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21898. "Construction of moving coils for electrical measuring instruments." F. C. Ellis. August 29th, 1938. (Divided out of 518728.) (518759.)

FORTHCOMING EVENTS

April 5th (Friday).

Institution of Chemical Engineers.—Hotel Victoria, Northumberland Avenue, W.C.2. 11 a.m. Annual meeting. 11.45 a.m. Presidential address on "Oil." 12.45 for 1 p.m. Luncheon.

Institution of Electrical Engineers (Meter & Instrument Section).—Institution, London, W.C.2. 6 p.m. "Developments in Surge Recording by Means of the Klydonograph (E.R.A. report)." By J. L. Candler.

April 8th (Monday).

I.E.E. (North-Eastern Centre).—The Newe House, Newcastle-on-Tyne. 6.15 p.m. "The Limitation of Transformer Noise." By B. G. Churcher and A. J. King.

I.E.E. (Western Centre).—Merchant Venturers' Technical College, Bristol. 6 p.m. Informal discussion on "What We Have Learned from the Recent Cold Spell." To be opened by W. H. Donald.

Institution of Rubber Industry (London & District Section).—Northumberland Rooms, Northumberland Avenue, W.C.2. 7 p.m. Annual meeting. Papers on "The Utilisation of Waste Rubber."

April 9th (Tuesday).

Illuminating Engineering Society.—E.L.M.A. Lighting Service Bureau, Savoy Hill, W.C.2. 6 p.m. "The Photometric Properties of Luminescent Materials." By W. E. Harper, Margaret B. Robinson and J. N. Bowtell.

Institution of Engineers and Shipbuilders in Scotland.—Institution, Glasgow. 6.30 p.m. "Electrolytic Action on Steel in Sea Water." By Dr. J. H. Paterson.

April 10th (Wednesday).

I.E.E. (Transmission Section).—Institution, London, W.C.2. 6 p.m. "The Development of a Pre-stressed ('Toughened') Glass Insulator." By P. M. Hogg. "The Performance of Glass Insulators & Comparisons with Porcelain" (E.R.A. report). By C. E. R. Bruce and Dr. S. Whitehead.

I.E.E. (South Midland Students' Section).—James Watt Memorial Institute, Birmingham. 7 p.m. Annual meeting. Paper on "Planned Development of an Electricity Undertaking." By H. H. Margary.

Institution of Engineers-in-Charge.—St. Bride Institute, London, E.C.4. "The Design of Electro-Medical Equipment." By J. Caldwell.

April 11th (Thursday).

Diesel Engine Users' Association.—Caxton Hall, London, S.W.1. 2.30 p.m. Discussion on 1939 Bulletin.

I.E.E.—Institution, London, W.C.2. 6 p.m. "The High-rupturing-capacity Cartridge Fuse, with special reference to short-circuit performance." By J. W. Gibson.

FINANCIAL SECTION

New Companies. Returns of Capital. Debenture Charges. Bankruptcies and Liquidations. Reports of Electrical Companies. Dividend Announcements. Stocks and Shares

New Companies Registered

Itonia Battery Co., Ltd.—Private company. Registered March 28th. Capital, £1,000. Objects: To acquire the business of battery manufacturers and electrical and general engineers carried on by D. S. Bilantz and A. Asrelwitch at 3, Leeds Place, Tollington Park, N.4, as "Bilantz & Asrelwitch." H. L. Alexander, 21, Raleigh Close, Hendon, N.W., signs as director. Solicitors: Rosenbloom, Dalton & Co., 4, Lloyd's Avenue, E.C.3.

J. B. Ridley, Ltd.—Private company. Registered in Edinburgh March 18th. Capital, £300. Objects: To carry on the business of wireless, electrical, mechanical, telephone, lighting, heating, motor and general engineers and engineering contractors, &c. Directors: J. B. Ridley, 26, Sunningdale Avenue, Newton Mearns, Renfrewshire, and R. P. Pringle, 249, King's Park Avenue, Rutherglen, Lanarkshire. Registered office: 97, Douglas Street, Glasgow, C.2.

Howard & Dennis, Ltd.—Private company. Registered March 27th. Capital, £6,000. Objects: To acquire the business of manufacturing engineers carried on by E. J. Howard and C. Dennis at the Bedford Engineering Works, Houghton Road, Bedford, and to carry on the business of electricians, mechanical, electrical, automobile and general engineers, &c. Directors: E. J. Howard, "The Quillet," Haynes, Beds, and C. Dennis, 5, Bedford Road, Clapham, Beds. Registered office: The Bedford Engineering Works, Houghton Road, Bedford.

Autricity, Ltd. — Private company. Registered March 19th. Capital, £100. Objects: To carry on business as manufacturers and repairers of and dealers in insulators, dynamos, motors, armatures, magnetos, batteries, &c. C. P. Mortarotti, of 8, Claremont Road, E. Twickenham, Middlesex, is permanent director. Secretary: D. M. Davis. Registered office: 226, Whitehorse Road, W. Croydon, Surrey.

Companies' Returns

Statements of Capital

St. Mary's (Scilly) Electricity Supply Co., Ltd.—Capital, £15,000 in £1 shares. Return dated December 7th, 1939. 10,452 shares taken up. £7,435 paid, £3,017 considered as paid. Mortgages and charges: £4,500.

Arun Electrical Supplies, Ltd.—Capital, £100 in £1 shares. Return dated December 29th, 1939. Three shares taken up. £3 paid. Mortgages and charges, nil.

Vaughan Crane Co., Ltd.—Capital, £150,000 in 50,000 preference and 100,000 ordinary shares of £1. Return dated December 28th, 1939. 16,880 preference and 53,578 ordinary shares taken up. £43,669 paid, £26,789 considered as paid. Mortgages and charges, nil.

Cressall Manufacturing Co., Ltd.—Capital. £15,000 in £1 shares. Return dated December 28th, 1939. 9,000 shares taken up. £9,000 considered as paid. Mortgages and charges, nil.

Mortgages and Charges

Baldwin Central Products, Ltd.—Mortgage on certain premises in Middle Avenue, Loughborough, Leics, dated March 9th, 1940, to secure £3,150, and further advances. Holders: Halifax Building Society.

Internal Telephone Services, Ltd.—Mortgage debepture, charged on the company's undertaking and property, present and future, including uncalled capital, dated March 5th, 1940, to secure all moneys due or to become due from the company to District Bank, Ltd.

L. Adams, Ltd.—Satisfaction in full on February 15th, 1940, of debentures dated May 3rd, 1938, and April 26th, 1939, and registered May 9th, 1937, and April 26th, 1939.

Small Electric Motors, Ltd.—Particulars filed of £10,000 debentures, authorised March 7th, 1940, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued, and ranking *pari passu* with existing debentures.

J. F. Poynter, Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated March 11th, 1940, to secure all such sums as are now or shall from time to time become owing to the chargee (Howard G. Poynter, 1, Coleridge Road, Crouch End, N.8) from the company not exceeding £500.

Titchfield Electro Surgical Co., Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated March 4th, 1940, to secure £300. Holder: Walter M. I. Ruppin, "Ravensdene," Holden Avenue, Finchley, N.11.

Batwin Electric Motors, Ltd.—Satisfaction to the extent of £1,000, on March 1st, 1940, of debenture registered June 14th, 1933. (According to the register of mortgages, the debenture registered June 14th, 1933, originally secured £1,000.)

Capital Increases

Switchgear & Equipment, Ltd.—The nominal capital has been increased by the addition of £27,500, in £1 ordinary shares, beyond the registered capital of £12,500.

London Electrical Co. (Sherborne Lane), Ltd.—The nominal capital has been increased by the addition of £2,000, in £1 ordinary shares, beyond the registered capital of £12,000.

Company Liquidations

E. C. Stokes, Ltd.—Winding up voluntarily. Liquidator, Mr. M. Andrews, Mitre House, High Street, Sutton, Surrey.

Belshaw & Co., Ltd.—Meetings April 30th pursuant to Section 245 of the Companies' Act, 1929, at 4b, Frederick's Place, E.C.2, to receive an account of the winding up by the liquidator, Mr. G. H. Baguley.

Bankruptcy Proceedings

R. A. Young, Gullet Passage, Shrewsbury, electrical and mechanical engineer.—The receiving order was made on debtor's own petition recently, and according to the statement of affairs filed there are ranking liabilities of £332 and estimated net assets of £24, leaving a deficiency of £308. Debtor attributes his failure to insufficient capital and cutting prices in order to meet competition.

E. N. Belsten, 245, Highters Heath Lane, Warstock, Birmingham, electrical contractor.—The first meeting of creditors was held at the Official Receiver's Office, Somerset House, 37, Temple Street, Birmingham, on March 28th. The statement of affairs showed ranking liabilities of £555 and estimated assets of £237, leaving a deficiency of £318. The case was left in the hands of the Official Receiver.

A. L. Pearce, 12, Fore Street, formerly Prospect Buildings, both Newquay, Cornwall, electrical supplies dealer.—This debtor applied for his discharge recently at the Town Hall, Truro. It was stated that the receiving order was made in February, 1934. The liabilities were estimated at £572, but proofs actually admitted totalled £602. The assets, which were estimated to produce £230, had realised £238 and a dividend of 4s. 8¾d. in the £ had been paid. The failure was attributed to insufficient turnover to meet trading and personal expenses. The discharge was granted, subject to one week's suspension, on condition that the debtor paid £35 for the benefit of his creditors.

J. H. Dollittle, radio engineer, 35, Queen's Road, Farnborough, Hants, lately trading at 145, Victoria Road, Aldershot, as Zenith Radio Manufacturing Co.—Last day for receiving proofs for dividend April 9th. Trustee, Mr. C. R. Waterer, 195-203, Waterloo Road, London, S.E.1, Official Receiver.

C. H. A. Sanders (Sanders Electric and Radio Service and Supplies), 231, Staines Road, Hounslow, Middlesex.—First and final dividend of 1¼d. in the £, payable April 10th at 29, Russell Square, London, W.C.1.

R. Robinson, electrical engineer, 11, Goodwood Avenue, Blackpool, lately trading at The Arcade, Waterfoot.—Supplemental dividend of 6d. in the £, payable April 9th at the Official Receiver's office, Byrom Street, Manchester, 3.

H. Mitchell, electrical engineer, 59, Parcmaen Street, Carmarthen.—Receiving order made March 21st on debtor's own petition.

H. J. Fowlie, electrical engineer, 40, Queen Street, Maidenhead.—Receiving order made March 21st on debtor's own petition.

H. White, radio and electrical engineer, Ridgeway Lane, near Ambergate, and lately trading at 38, Nottingham Road, Ripley, Derbyshire.—Last day for receiving proofs for dividend April 13th. Trustee, Mr. A. J. Rogers, 22, Regent Street, Park Row, Nottingham, Official Receiver.

Reports and Dividends

Associated Electrical Industries, Ltd., held its annual meeting on March 29th, when Sir Felix Pole (chairman), who presided, in reviewing the accounts for 1939, said that it would be seen that whereas they started with a profit for the year of £70,766 more at £1,470,265, they arrived at a net profit of £477,085, or 28.2 per cent. less than the corresponding amount for the previous year, due to larger provision for taxation. As the stockholders were aware, they had been engaged for several years in carrying out, in collaboration with another large British electrical manufacturing company, an important railway electrification contract in Poland. This work had just been completed at the time of the German invasion of Poland in September last, but, of course, all the payments under the contract had not been made. Full provision had been made in the accounts, however, for any losses which might arise in connection with this contract and one or two smaller contracts from Poland. In addition they had written off an investment which they had in a company having interests in Poland.

Their engineering and research departments were working on many important problems in collaboration with the scientific departments of the various Services. They were also continuing their policy of securing as much export business as possible. To that end they were maintaining an efficient organisation abroad and keeping in personal contact with overseas markets. The Government, through the Export Council which had been appointed by the President of the Board of Trade, appeared to contemplate giving more assistance than hitherto to exporting companies. In that connection they had pointed out the difficulty of obtaining large contracts for electrical and mechanical installations because of the risk incidental to quoting firm prices in view of the rising costs of wages and materials. Some of their foreign competitors were not faced with this trouble, and they felt that the Government should assist the British manufacturer in dealing with this problem. They continued to have many orders from the Dominions, the Colonies, and foreign countries, the most recent large order being from Turkey for the construction of a large power station at Catal Agzi, the value being about £1,500,000. Reverting again to the question of exports, he was glad that the Government had embarked upon an enlarged scheme of colonial development.

The Metropolitan-Vickers Electrical Co. had on hand a larger volume of orders than ever before for turbo-alternator sets, transformers, switchgear, electric winders, electric rolling mill equipment, hydro-electric installations, electric locomotives, and other electrical apparatus. They had a record number of employees.

while as regards all the companies of the Associated Electrical group, orders on hand exceeded £19,000,000, and the number of employees was the highest in their history and was still growing. Although theirs was a reserved industry, they had nearly 3,000 employees serving with the Forces, and a scheme was in operation whereby the Service pay of married men, and single men having dependants, was being supplemented by suitable allowances from their various companies. Also much was being done to support the National Savings Scheme.

British Insulated Cables, Ltd., held their annual meeting on April 2nd. Sir Alexander Roger (chairman), who presided, said that in the first eight months of the year under review conditions were difficult but satisfactory, and the 1938 level of business was being maintained in all their departments. With the outbreak of war entirely different conditions arose. Copper, their principal raw material, lead and many other of their important requirements became controlled. Wages and other costs began to rise, and after the first abnormal rush of general orders designed to fill empty shelves, there was a partial falling off in some departments, whilst in others both their personnel and plant were working to day and night capacity. Demands from electricity supply authorities had fallen, and work on their important L.N.E.R. contract had been largely suspended. The bulk of their home business, either directly or indirectly, was to meet war requirements. So far as the subsidiaries were concerned, British Copper Refiners was out at full stretch, while the other subsidiary companies were more than holding their own.

With regard to export trade, conditions were not easy, but their normal overseas business, excluding large contracts, showed an increase over the 1938 figures. Every endeavour was now being made to achieve a further substantial improvement. Although they were engaged in a reserved occupation, over 600 of their staff and workpeople were serving with the Forces. Allowances had been made to them, the membership of the pension fund was maintained, and an undertaking had been given that re-employment would be found on their return. Regarding the outlook for the current year, there had been an unavoidable slackening off in the demand for some of their products, while costs had increased and working conditions were difficult. In the aggregate, however, they had a record balance of orders on the books, and it was clear that, in certain of their departments at least, capacity output would be required for many months ahead. If this general position was maintained throughout the year, they should be able to show satisfactory results.

Enfield Cable Works, Ltd.—Presiding at the annual meeting held on March 29th the Earl of Verulam (chairman and managing director), who presided, said that the Australian subsidiary had had an excellent year's trading and had paid the same dividend as in 1938. Other stock and share investments included a substantial investment in the ordinary shares of Enfield Rolling Mills, Ltd., which was doing well to-day.

The Brimsdown Rubber Co. was formed as a subsidiary of the Cable Works in April, 1938, and it bought the derelict factory of the former Brimsdown Lead Co., next door to their rubber cable shop. The first twelve months had been taken up with reconstructing the building, in one section of which they planned the manufacture of mechanical rubber goods and in the other the production of sheet goods and of printed rubber sheeting, previously imported almost wholly from abroad. For the last three months sales had exceeded £10,000 a month, and in their next balance sheet, if things went on as they were going now, the whole of the loss of £8,298 would have been wiped out. This company had the further advantage to them that by raising to capacity the output of the rubber mill in their rubber cable factory, it reduced to a competitive basis the cost of all their rubber mixings for both factories.

With regard to the future, most of their raw materials had to be imported and in connection with some of them, there were difficulties and anxieties as to the provision of shipping space. They made various kinds of cable, and the war created a huge demand for cable insulated with rubber, but seriously reduced the demand for cable insulated with paper. The machinery that made the latter could not be adapted to make the former. Moreover, orders taken from the Government were placed at strictly controlled prices. As to the danger from air raids, as a consequence of arrangements entered into many years ago with some of their friends in the cable-making industry, if the company's factory was bombed they could look to those friends for co-operation in the conduct of the company's business so that its potential loss would be substantially lessened.

Enfield Rolling Mills, Ltd.—Speaking at the annual meeting held on March 29th the Earl of Verulam (chairman) said that all departments had a large volume of orders on hand and as far as they were able they were assisting in the drive for export business which was so vitally needed.

The Telephone and General Trust, Ltd., held its annual meeting on March 29th when Sir Alexander Roger (chairman and managing director) said that the item "Advances against security," which represented the credits given to the Polish undertaking of posts, telegraphs and telephones, now disappeared. All payments were promptly received with the exception of the final payment of just over £9,000 which under the moratorium declared in November last had been postponed.

Referring to the telephone companies in which the Trust is interested, Sir Alexander said that the number of stations in Portugal had increased from 21,127 in 1927 to 52,506 in 1939, and the net addition to capital expenditure had amounted to £1,500,000. In Venezuela, the Nacional Telephone Co. had experienced great activity. The expansion since 1935 had been remarkable and stations in service had increased from 14,176 to 26,624 and an expenditure of almost £400,000 had been incurred on capital account. The quinquennial programme envisaged further extensive development. Business in their subsidiaries in the West Indies continued to expand and the total number of telephones operated by their companies was just under 15,000.

The British Aluminium Co., Ltd., held its annual meeting on March 29th when Mr. R. W. Cooper (chairman), who presided, said that they had further records to report for the year 1939, both as regards production and volume of sales. The aggregate production at their older works was higher, but the largest increase took place at their Lochaber works, and they still had a materially greater output to look forward to from this source. Extensions at their various works which were in progress a year ago were duly completed, and further substantial additions were now being carried out. Their new alumina factory was successfully put into commission in the spring of last year and was already being enlarged. They had decided to proceed immediately with the construction of the last stage of their Lochaber scheme, and work had already commenced. It had been found advantageous to vary certain of the final works as authorised by Acts of Parliament, and the Lochaber Power Co. had made application for a Provisional Order so that the substituted works might have statutory authority. The developments of their allied companies had made steady progress, although the programmes for their completion had been somewhat retarded.

Up to the outbreak of hostilities they were successfully developing the use of aluminium in many directions. Then they came under the control of the Ministry of Supply, and they were obliged to cancel orders and contracts on their books for commercial uses of aluminium in this country and for export business. Shortly thereafter the Ministry made arrangements with them under which it purchased the whole of their production of ingot aluminium and sold and distributed the metal itself. This contract with the Ministry extended up to the end of 1940, and was subject to renewal, the prices being based on those current in this country before the war. In co-operation with the Ministry of Supply they were engaged in very largely increasing the production of aluminium in this country and work in this direction was proceeding energetically.

Brown Brothers, Ltd.—Presiding at the annual meeting held on March 29th Mr. J. A. Thomson (chairman and managing director) said that the war had led to an increased demand for radio sets. Their electrical and side-lines departments had been engaged in the development and sale of A.R.P. equipment. They had during the year acquired the business of A. J. Dew & Co., Ltd. Foreign Government restrictions had made trading with European markets increasingly unprofitable, and they were therefore directing their energies to increasing their trade with the Colonies and Dominions. This policy had been amply justified, and their export department had shown satisfactory results for the past year.

The Bournemouth and Poole Electricity Supply Co., Ltd.—Presiding at the annual meeting held on March 29th, Sir Robert Renwick, Bt. (chairman), said that the sales of electricity to consumers had increased by 5.7 million kWh to a total of 72.2 million kWh, which represented an increase of nearly 9 per cent. over 1938. Up to the outbreak of war the increase was of the order of 15.6 per cent. over the corresponding period of the previous year. They were faced with considerable difficulty in framing any estimates for the future, a difficulty which was general in all the public utility undertakings to-day. Even with an area so advantageously placed as the Bournemouth and Poole area, there were quite material fluctuations from week to week in the output of the company, which fluctuations, of course, affected the revenues.

On the other side, however, in respect of expenditure, there was an almost week by week increase going on. Nevertheless, the board had refrained from imposing any general increase in the tariffs of the company. Those tariffs were low and advantageous to their consumers, and they felt that with the advantages of their area it should not, and they hoped it would not, be necessary to raise their prices yet awhile at any rate. They had extended their system to six other districts in their very widespread area, and prior to the outbreak of war they were embarking upon a further street lighting programme. With regard to their subsidiary companies—Blandford, Milton, and Milford—the year's work in each case had followed very closely the experiences of the parent company.

The Richmond (Surrey) Electric Light & Power Co., Ltd., held its annual meeting on March 28th, when Sir Robert Renwick, Bt. (chairman), who presided, said that the war had not only arrested their progress and development, but had resulted in a severe setback in respect of their business. Up to the outbreak of war the company was enjoying an output of 8 per cent. over that of the corresponding period of the previous year, but for the last four months of the year there was such a decline as resulted in a decrease of 21 per cent. in their sales of electricity as compared with the corresponding four months of the previous year.

The load on the system was almost wholly of a shopping and residential nature, and the lighting restrictions could be said to be solely responsible for the decline. As a result, the sales to consumers in the year showed a drop from 13.9 million kWh in 1938 to 13.5 million kWh. This decrease of half a million kWh compared with an increase of 8½ per cent. in 1938. It was difficult to estimate receipts for the future under present conditions. Their expenses, however, had increased materially and were likely to continue their upward trend. For this reason a decision was taken to put into force increases in the rates for supply operating from January 1st of this year. The overall increase in tariffs, which they were bound to put into force, was of the order of 14½ per cent. over their pre-war tariff. Sir Robert referred to the attacks made upon electricity supply companies for increasing their charges, and said that the criticisms were unjustified.

The South London Electric Supply Corporation, Ltd.—Presiding at the annual meeting held on March 28th, Lord Gainford (chairman) said that the area of supply of the company covered a district treated as an evacuation area, and on the outbreak of hostilities they lost a considerable number of consumers. The abolition of street lighting and the general effects of the black-out had both had effects on the results for the year. Whereas for the whole year the kWh sold showed an increase of 1.2 million, or 1.7 per cent. over the previous year, up to

the end of August, 1939, the increase was of the order of 4.5 millions, or 10.7 per cent.

A revision of the bulk supply agreement took effect from January 1st, 1939, but, unfortunately, the benefit of the revised terms had been to a great extent offset by the large increase in coal costs, the price of which was a component in the bulk supply agreement. In spite of the increasing costs of their raw materials, they were able to postpone increasing the rates for supply to consumers until January 1st. The increases then made were moderate and were introduced only to meet the higher costs which they were having to bear, and did not have regard to the loss of revenue attributable to wartime restrictions.

The Hoffmann Manufacturing Co., Ltd., held its annual meeting on March 29th. Mr. A. O. Peech, who presided in the absence of the chairman, said that 1939 had been a year of exceptional difficulty for the company. As the year advanced it became clear that the demands upon them would quickly reach new records. Every possible effort had been made to meet this, but the usual difficulties in connection with manufacture under wartime circumstances, the loss of some hundreds of men to the colours and the necessary training of large numbers of employees for replacement and extension had had to be overcome. Their subsidiary company in the United States continued to prosper and expansion took place as the demand required. To some extent they had been able to draw on them to augment their home production. With regard to their associated company in Germany, ample provision had been made in their accounts to meet any contingencies.

W. Canning & Co., Ltd., held their annual meeting on April 1st, when Sir Ernest Canning (chairman), who presided, said that it was very satisfactory that he could report that their trading profits had recovered their earlier standard. With regard to their present work, he could say nothing except that most sections of their business were engaged to full capacity on work of national importance. They had one or two departments catering for civil trades that were quiet, solely because their customers could not obtain all the materials they required. They were fortunate that their war work ran along their ordinary channels of trade so that when peace arrived their troubles of changing over should be negligible. They had spared no efforts in carrying out the Government's exhortation to maintain exports, and they had done this with marked success. Their chemical research work was being maintained, and they had executed important contracts in connection with bright nickel plating, and their research promised further benefits to the company when civil trade was renewed once more. Their new works in Constitution Hill were now completely equipped.

Lancashire Dynamo & Crypto, Ltd., held its annual meeting on April 1st. Mr. A. E. L. Chorlton (chairman), who presided, said that the whole of the authorised capital was now issued. The premium on the 13,000 ordinary shares issued last year had been added to reserve which, with this year's allocation, would now amount to £300,000. There were now no charges or debentures outstanding against the parent company or any of the associated companies. All the associated companies had made reasonable profits in the past year.

The company commenced 1940 with record order books. Future results would depend largely upon the availability of raw materials. The whole resources of the company were at the disposal of the Government and all the works were occupied with Government work or export trade. They had more export orders offered to them than they had been able to handle and unless greater supplies of raw materials were made available it was difficult to see how exports could be increased.

The Midland Electric Corporation for Power Distribution, Ltd.—Presiding at the annual meeting held on April 2nd Mr. G. H. Nisbett (chairman) said that capital expenditure had increased during the year by £215,566, and included two new tappings on their 33-kV ring main system and a new tapping from the 132-kV grid system. They also laid 77 miles of new cable. New installations on hire-purchase showed a fall on the year. Since the outbreak of war they had naturally been more discriminating in their acceptance of this class of development, and had also shortened their periods of hire-purchase. They were, however, continuing to give substantial help to intending consumers, their expenditure during the year having exceeded £15,000

The number of new connections, at 6,117, compared with an addition of 7,427 in the previous year, but on the other hand their connections in kW at 27,749 compared favourably with 21,366 in the previous period. The fall in the number of new consumers was due entirely to the diminution in the building of new houses. The demand for power, however, continued to increase, so that in kilowatts connected they had a record year. So far this year applications for new power and the output of kWh were increasing at a greater rate than ever before. As from the end of last year the West Midlands Joint Electricity Authority had been forced to increase its charges to them for bulk supply by partly operating its coal cost adjustment clause, representing an increased payment of £38,000 by them for their supply. In addition, they had to bear increases on the whole of their materials and on wages. So far no increase of any description had been made in their charges to the public.

Referring to the steps taken to protect their system in the event of air raids, Mr. Nisbett said that the general layout of their distribution system was such that a duplicate supply was available in every district and in many cases they had a number of alternatives. They had, therefore, concentrated on protecting vital points and personnel. They had arranged for an entirely separate supply from the grid by arrangement with the West Midlands J.E.A., and from there they could feed separately into their existing northern and southern systems. They had also provided two additional substations as feeding points from the 33-kV mains into the 1,000 miles of general network. The cost was roughly £150,000, but these provisions merely anticipated ultimate requirements to meet the rapidly growing load.

The Clyde Valley Electrical Power Co. held its annual meeting on April 2nd when Mr. C. Ker (chairman), who presided, said that the accounts showed another year of progress hindered a little by the prevailing conditions. The No. 9 generator (30,000 kW) and boiler plant at Yoker power station came on load in June and were operating satisfactorily. The new switchhouse annex at Clyde's Mill had been completed and work had begun in connection with a further 30,000-kW generator, together with boilers and ancillary plant, for which authority was obtained in 1939. Distribution extensions during the year included 270 miles of underground and overhead lines, 58 miles of service cable and 102 substations, kiosks and pole transformer equipments.

Sales during the year to their own customers—529 million kWh—showed an increase of 65 millions, or 14 per cent. over 1938. Of this increase, 54 million kWh was for industrial purposes, and 11 million kWh for domestic use. An analysis under "Classified trades" showed increases in all sections, particularly in the heavy industries. The average rate received from consumers was 0.6780d. as against 0.6757d. in 1938, while the combined average rate of the company and its subsidiary, the Strathclyde Electricity Supply Co., Ltd., was 0.7523d. as compared with 0.7573d. Connections of new consumers were satisfactory, despite a drop in the figures during the final months. A total of 12,678 consumers was added during the year with a connected load of 54,587 HP. The total number of consumers as at December 31st, 1939, was 171,579, just over five times the number ten years ago.

The Automatic Telephone & Electric Co., Ltd.—Presiding at the annual meeting held on April 3rd Sir Alexander Roger (chairman) said that Elexcel, Ltd., maintained its satisfactory profit level and was fully employed, although the domestic cooker business had almost ceased. The war naturally brought the telephone branch of the Post Office new and complex problems, and the signalling services of the Forces made heavy inroads on their engineering personnel. This was unfortunate. The annual report of the American Telephone and Telegraph Co. mentioned that good telephone service involved plant facilities and organisation, adequate not only to take care of everyday needs of the nation, but also to meet sudden, and perhaps unprecedented, surges of demand for telephone connection. This was precisely the policy which the Post Office had been pursuing with success for some years. It strove to provide a no-delay trunk service and an equally rapid local service. There would seem to be a tendency to starve and restrict the expansion of the telephone service. If this was persisted in at a time when all industrial effort must be keyed up to concert pitch, it could only act as a brake on production and on commerce generally. Ever since the outbreak of the war the Post Office had taken a broad view of the position which they and their contractors faced. He would, however, urge upon the Government that every assistance in finance and material should be rendered to this vital branch of our national life, recognising that rapid communication was an essential part of the military and commercial and social system.

The excess profits tax in its present form was inequitable in several essential respects. The telephone industry was comparatively new in this country. It was not many years since almost all telephone plant and apparatus was imported. A few manufacturing concerns set out to alter this parlous state of affairs, and the industry became self-contained. It planned its operations on the basis of a large and badly wanted telephone development in this country with export business as a corollary. Large capital was raised and risked, heavy annual sums were expended out of revenue on technical research and development, together with almost equally heavy expense for overseas exploitation. The harvest was at hand when the E.P.T. was introduced and war broke out.

Welcoming the newly formed Export Council, Sir Alexander said they also welcomed the statement that arrangements should be built on the normal structure of trade on the assumption that the sounder and healthier would be the state of the trading organisation when more critical and testing conditions were likely to be encountered. In conclusion, he said that if supplies and man power were maintained they had little doubt that their output for 1940 would show an increase on that for 1939.

A. Reyrolle & Co., Ltd., report that after writing off certain capital expenditure and providing for depreciation, the profit for 1939, including interest received on investments and loans, amounts to £162,213, as compared with £187,476 for 1938, which, with £142,638 brought in, less £6,950 voted at the last annual meeting for distribution among the local charitable and other funds, makes £297,901 available.

It is proposed to pay a final dividend on the ordinary stock of 7½ per cent., making 12½ per cent. for the year (unchanged), and to carry forward £148,637. After writing off £65,730 for depreciation, together with certain other items, including expenditure on air-raid precautions, a net amount of £79,951 has been added to fixed assets in respect of buildings and plant. Expenditure on the short-circuit testing station, amounting to £3,675, was charged to development expenditure account. Orders received in 1939 were greater than in 1938, and with the large amount of special work undertaken the volume of orders in hand at the end of the year was considerably increased.

The Philco Radio & Television Corporation reports a trading profit for 1939 of £5,208, as compared with a loss of £108,885 for the previous year. Bank interest absorbs £1,388, depreciation £7,236 and directors' fees £414, leaving a net loss of £3,830 (compared with £115,589). Against the loss is credited £10,209 contingent reserves no longer required and £25,734 profit arising from U.S.A. debt settlement. There has been appropriated to exchange differences £1,407, estimated losses on liquidation of a subsidiary £11,503, and bank debenture expenses £453, leaving a credit balance of £18,750. This reduces the debit brought in to £299,618.

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STOCKS AND SHARES

Tuesday Evening.

THE price of the three-and-a-half per cent. War Loan advances steadily to the neighbourhood of 100. This makes an excellent advertisement for investment securities of all kinds round the Stock Exchange markets. Business, it is true, comes by fits and starts. Of the evidence that capital is available for employment in stocks and shares, every day furnishes fresh examples.

A good deal of attention is being paid, at the present time, to shares in the manufacturing and equipment companies. The supply of the shares is by no means unlimited; every purchase means a further contraction in the amount of stock available. Of outstanding features there are not many to be noted this week. One of the principal is a general rise in the junior stocks of the Home Railway companies. London Transport "C," at 44, has risen 10s.; the senior stocks of the Board have also strengthened.

Trustee Stocks

The senior London Transport Board issues stand at prices which give trustees the chance of investing funds at a higher rate of yield than is afforded by the majority of trustee securities. The 4½ per cent. "A" stock, for instance, at 109½, pays over 4 per cent. on the money and cannot be redeemed for 45 years at the earliest, so that the premium in the price of 9½ points—which must eventually be lost on redemption—is no serious matter. The 5 per cent. "B" stock commands the same price, giving a current yield of £4 11s. 1d. In this latter case, however, redemption at 100 can be effected in 25 years' time, so loss of capital in that event is a more material consideration.

Railway Securities

Both the above stocks are quoted at prices well below the best of last year. In contrast, the majority of British Government issues stand higher than at any time in 1939 and give an average yield of about 3 per cent. By virtue of their companies' dividend records, the senior issues of the Great Western and Southern Railways come into the category of Chancery Trust stocks and are, therefore, eligible for trustees. Funds can be invested in the debenture, guaranteed and preference stocks to give returns of from about 4 up to practically 5 per cent., the latter being obtainable, for instance, from Southern 5 per cent. preference stock at 100.

Electricity Supply Shares

Although a little off colour here and there, the market in electricity supply shares stands quietly firm at a range of prices which, broadly speaking, is higher than that ruling in the miscellaneous industrial market. The declines this week in the prices of, for instance, Scottish Powers, at 35s. 9d., North Easterns, at 29s. 6d., Northmet Powers, at 38s. 9d., and "City Lights," at 26s., are of minor importance, and, incidentally, show an impartial attitude towards the relative merits of the London and the Provincial issues. The distinction has, of course, been clearly demarcated during the progress of the season of the company reports and meetings, and is recognised in the difference in yields between the two groups. The report of last week's meeting of the Bournemouth and Poole Company brought out the advantages possessed by the undertakings supplying "reception" areas. A line of Edmundsons' ordinary shares is on offer at 26s. to yield £4 12s. 4d. per cent. on the current rate of 6 per cent. dividend. Units sold by the group in the first six months of the war were 17 per cent. more than the corresponding total in 1938-9.

Cable Manufacturers' Shares

A firm of London Stock Exchange brokers gives permission to quote from a part of their monthly review dealing with shares under the above heading. The theme argues that wartime seems unlikely to upset the reputation of the leading cable manufacturing companies' shares as payers of consistently satisfactory dividends. The firm goes on to say that while the expansion of the electricity supply and private building industries is now held in check, profits of the cable manufacturers have shown themselves to be influenced to the greatest extent by the level of general industrial activity. Thus, completion of the main part of the "grid" in 1932 proved no hindrance to the steady growth of profits during the industrial recovery from 1933. Contrariwise, it is to be admitted that the continuous growth of electricity consumption failed to prevent the last industrial slump from leaving its mark on profits. It apparently follows that, in wartime, the companies' most important market—that of industrial expansion and activity—is going to be exceptionally busy.

Stable Dividends

Although the trade is affected by the varying fortunes of the capital industries, it is pointed out that profits have nevertheless followed a course of reasonably even tenor, for which thanks are due, in large part, to the existence of the Cable Makers' Association. This body, of which the leading companies are members, has exerted a successful measure of control over competition and prices and, although challenged from time to time by outside manufacturers, remains a strong stabilising factor.

Dividend policies of the various companies have aimed at a still higher degree of stability. By dint of under-distributing profits in the good years, and of making liberal payments in the leaner periods, dividends have generally followed a very level course. In the process, the companies have tended to build up substantial reserves, and an occasional capital bonus, with the dividend subsequently maintained on the larger capital, has given shareholders a better return than appears on the surface.

De-Gaussing

To the probability of heavy wartime demands for cable throughout industry generally, the Stock Exchange firm concludes, may be added the likelihood of increased purchases by the shipbuilders, in which sphere the new de-gaussing device, for protection against magnetic mines, and involving the circling of ships with electric wires, may be a factor; also the field of telegraph and telephone cables is not likely to be any less active than before. On balance, therefore, this well-controlled industry can be relied upon to remain well employed in wartime, and the excellent profits made from 1935-37 seem to rob E.P.T. of most of its terrors. Shares of the kind discussed are recommended with confidence as sound holdings in war or peace.

Equipment and Manufacturing

Persistent buying of Johnson & Phillips' shares, in advance of the Company's report, has been this week's feature of the market in electrical equipment issues. The quotation has risen by 1s. 9d. further to 50s., with a number of bargains recorded over the latter price. Expectation looks for a final dividend making at least 15 per cent. for the year, against 12½ per cent. previously. Of the other cable shares, British Insulated are on the dull side at 86s. 3d. Associated Electrical Industries slipped back 6d. to 39s. 6d. after the annual meeting, although Sir Felix Pole's review left an impression of very busy conditions throughout the group. Attention was drawn to taxation, provision for which had increased so far as to have absorbed more than the year's rise in trading profits. In the sphere of export business, the chairman would evidently like to see Government assistance in the matter of quoting firm prices for large electrical contracts without the risk of loss through an intervening rise in manufacturing costs.

Elsewhere in the electrical equipment share market, there has been a certain amount of interest in telephone shares since the issue of the satisfactory reports by Ericssons and Automatic Telephone and Electric, but prices show no quotable change of consequence. Telephone Manufacturing have hardened to 8s. 9d. Switchgear and Cowans remain depressed at 7s. 6d. prior to the annual meeting, the report having shed little light on the reason for the sharp contraction of profits which necessitated the halving of the dividend. Lancashire Dynamos have been steady at 55s. since the appearance of the full accounts.

Telegraph Construction

The new issue of Telegraph Construction shares had to be applied for at the latest on Tuesday in this week. The company announced a bonus, it may be remembered, of one new share free for every 20 old shares; and, in addition to this, one new share at 30s. for every six old shares held.

With a promptitude as unusual as admirable, the certificates for the new shares were distributed a week ago. The price of the new shares opened at 6s. premium, to close at 8s. 3d. premium on Monday in this week. Considering the position of the undertaking, and the business which it is now handling, an improvement to 40s. does not seem to be unreasonable to expect. The chairman of the Enfield Cable Works spoke at the annual meeting of the difficulties and problems to which such undertakings are to-day subject. He, also, on the same day, referred to the manner in which Enfield Cables works in co-operation with Enfield Rolling Mills. The price of the latter Company's ordinary shares is 15s.; the 4½ per cent. debenture stands at 98.

Miscellaneous Matters

General Electric 6½ per cent. "A" preference shares are in the market at 32s., a price rather lower than has been paid in former weeks; the yield is just over 4 per cent. British Thomson-Houston 7 per cent. preference can be bought at 32s. 6d. to give £4 6s. per cent. on the money, and Crompton Parkinson "eights" at 36s. 6d. to return 1s. 6d. per cent. more. For investment which objects to paying a high premium over the nominal value of preference shares, South Metropolitan Electric four per cents. are on offer at 20s. 3d. Among traction and transport shares, dealings in Home Railway junior stocks have been more animated—and more bullish—than in most other markets this week. British Electric Traction deferred has lost 50 points after the previous week's advance of 25 points, declining to 750. West Ridings, too, are dull at 33s. 6d., having shed 1s., and Tillings are a few pence down at 42s.

Among the issues of overseas undertakings, Brazilian Tractions, at 10¾, and Rio 5 per cent. bonds at 90 ex-dividend, reflect the growing hopefulness over the wartime prospects for the South American continent. Cable and Wireless preference is a point off, at 96½, but the ordinary faces the dividend announcement, which is due next week, with confidence.

ELECTRICAL COMPANIES' SHARES

Prices, Dividends and Yields

Company	1939 High-est	1939 Low-est	Dividend Pre-vious	Dividend Last	Price April 2	Rise or Fall	Yield p.c. £ s. d.
Home Electricity Companies							
Bournemouth and Poole ...	68/3	56/–	15	15	62/6	—	4 16 0
British Power and Light ...	30/9	21/–	7	7	28/6	—	4 18 3
City of London	33/9	22/–	7½	7½	26/–	–6d.	5 15 5
Clyde Valley	38/6	26/9	8	8	37/6	—	4 5 5
County of London... ...	46/9	28/–	10½	10½	38/3	–6d.	5 10 0
Edmundson's :							
7% Pref....	31/6	27/6	7	7	30/–	—	4 13 4
Ord.	27/9	18/–	9	6	25/6	–6d.	4 12 4
Elec. Dis. Yorkshire ...	41/6	32/–	9	9	39/6	—	4 14 2
Elec. Fin. and Securities ...	48/3	39/–	12½	12½	40/–	—	6 5 0
Elec. Supply Corporation...	51/9	40/–	12	12	44/–	—	5 9 0
Isle of Thanet	20/–	15/–	4	4	15/–	—	5 6 8
Lancs Light and Power ...	34/6	25/–	7½	7½	32/6	—	4 12 4
Llanelly Elec.	22/6	16/6	5½	5½	21/–	—	5 4 9
Lond. Assoc. Electric ...	30/–	18/–	7	5½	20/–	—	5 10 0
London Electric	34/3	20/–	8	7½	27/–	—	5 7 8
London Power Deb. Red....	106½	97	5	5	104½	—	4 15 6
Metropolitan	51/–	32/6	12	10	38/9	–¼	5 3 3
Midland Counties	39/6	30/–	8	8	37/0	—	4 6 6
Mid. Elec. Power	41/9	33/6	8	9	38/9	—	4 13 0
Newcastle Elec.	28/9	25/–	7	7	28/9	—	4 17 5
North Eastern Electric :							
Ordinary...	32/3	23/6	7	7	29/6	–6d.	4 15 0
7% Pref....	32/6	26/–	7	7	31/–	—	4 10 4
Northampton	48/–	41/–	10	10	42/6	—	4 15 0
Notting Hill 6% Pref. (£10)	13¼	10½	6	6	10¾	—	—
Northmet Power :							
Ordinary...	46/6	30/6	10	10	38/9	–¼	5 3 3
6% Pref....	29/–	23/6	6	6	29/0	—	4 2 9
Richmond Elec.	29/–	21/6	7	6	23/9	—	5 1 1
Scottish Power	38/6	27/6	8	8	35/9	–6d.	4 9 4
Southern Areas	22/9	17/–	5	5	20/6	—	4 17 7
South London	30/9	22/–	7	7	22/6	—	6 4 3
West Devon	23/3	18/–	5	5	18/9	—	5 6 8
West Glos.	21/3	15/–	2	2½	20/–	+¼	2 10 0
Yorkshire Elec.	38/6	27/9	8	8	38/9	—	4 2 5
Overseas Electricity Companies							
Atlas Elec....	4/3	1/6	Nil	Nil	3/6	–3d.	—
Calcutta Elec.	39/–	25/–	10*	10*	36/–	—	—
Cawnpore Elec.	34/6	27/3	10	10	28/9	—	—
East African Power ...	26/3	20/–	7	7	24/6	—	5 14 3
Jerusalem Elec.	24/6	21/–	7	7	24/–	—	5 16 8
Kalgoorlie (10/–)	10/6	9/–	7½	7	12/6	—	5 12 0
Madras	31/–	21/3	8*	8*	26/3	—	—
Montreal Power	35½	30	1½	1½	34	+½	—
Palestine Elec. " A " ...	27/3	19/6	7½*	5*	25/–	—	4 0 0
Perak Hydro-electric ...	19/6	12/6	6	2½	17/6	—	2 17 4
Shawinigan Power ...	25	20	83cts.	90cts.	23¾	–½	—
Tokyo Elec. 6%	63	33	6	6	68½	—	8 15 2
Victoria Falls Power ...	73/9	60/–	12½	15	74/6	—	4 0 6
Whitehall Investments Pref.	19/6	10/–	7½	7½	17/–	—	8 16 6
Public Boards							
Central Electricity :							
1950–70	112	103	5	5	109	—	4 11 7
1955–75	115½	104½	5	5	111	—	4 10 0
1951–73	106½	101	4½	4½	107	—	4 4 0
1963–93	95½	84	3½	3½	95½	—	3 13 8
London Elec. Trans Gtd....	88½	83	2½	2½	91	–½	2 15 0
London & Home Counties							
1955–75	107½	105	4½	4½	106½	—	4 4 6
Lond. Passenger Transport							
A	114½	103	4½	4½	109½	—	4 2 2
B	117½	102	5	5	109½	+1	4 11 2
C	83½	64½	1½	—	44	+½	—
West Midland Joint Elec.,							
1948–68	112½	104½	5	5	106½	—	4 14 0
Telegraph and Telephone							
American Tel. & Tel. ...	210	159	9	9	210	–2½	4 5 8
Anglo-Am. Tel. :							
Pref.	101½	82	6	6	98½	–1	6 1 10
Def.	23⅝	17	1½	1½	23	—	6 10 4
Anglo-Portuguese	24/–	16/6	8	8	22/6	—	7 2 3
Cable & Wireless :							
5½% Pref.	97	75	4½	5½	96½	–1	5 14 0
Ord.	57½	35	4	4	61½	—	6 10 0
Income	100	85½	—	—	99½	—	4 0 5
Canadian Marconi $1 ...	6/–	3/9	Nil	4cts.	5/3	–3d.	—
Globe Tel. & Tel.							
Ord.	32/3	22/6	7½*	7½*	31/3	—	4 16 0
Pref.	26/9	20/–	6	6	28/9	—	4 3 5
Great Northern Tel. (£10)...	38	18	20	20	19½	—	10 5 4
Inter. Tel. & Tel.	10½	5	Nil	Nil	5	—	—
Marconi-Marine	30/–	23/–	7½	10	28/9	—	6 19 4
Oriental Telephone Ord. ...	2½	42/6	12*	12*	2 13/16	+1/16	4 5 5
Telephone Props.	14/–	12/9	5	6	13/9	—	8 14 6
Telephone Rentals (5/–) ...	10/–	6/3	10	10	9/–	+3d.	5 11 3
Western Union	40½	19½	2¾	—	32½	—	—
Traction and Transport							
Anglo-Arg. Trams :							
First Pref. (£5)	7/6	3/6	Nil	Nil	4/–	—	—
4% Inc.	16	5	Nil	Nil	11½	—	—
British Electric Traction :							
Def. Ord.	950	500	5	5	750	–25	—
Pref. Ord.	164	115	8	8	165	—	4 17 0
Bristol Trams	52/6	35/–	10	8*	48/3	—	3 6 6
Brazil Traction	13	6½	$1	50c.	10¾	+½	—
Calcutta Trams	25/6	20/9	8	8	23/6	—	6 16 2
Cape Elec. Trams	18/–	16/9	5	5	16/6	—	6 1 3
Lancs Transport	37/9	27/6	10	10	35/–	—	5 14 8
Mexican Light :							
1st Bonds	35	20	5	5	30½	—	—
Rio 5% Bonds	82	47	5	5	90xd.	+6½	5 11 1
Southern Rly. :							
5% Prefd.	75½	48	5	5	70	–1	7 2 10
5% Pref....	99½	79	5	5	100½	+1	4 19 6
T. Tilling	2½	32/6	10	10	42/–	–6d.	4 15 3
Tilling & B.A.	54/6	43/9	9*	8*	47/6	—	3 7 10
West Riding	37/9	30/–	10	10	33/6	–1/–	5 19 5
Equipment and Manufacturing							
Aron Electricity Ord. ...	32/3	17/6	15	15	17/6	—	—
Assoc. Elec. :							
Ord.	45/3	30/–	10	10	39/6	–6d.	5 1 3
Pref.	36/6	30/–	8	8	35/–	—	4 11 5
Automatic Telephone & El.	48/9	37/–	10	12½	45/–xd.	+¼	5 11 1
Babcock & Wilcox ...	48/–	37/–	10	12½	46/3	—	5 8 2
British Aluminium Ord. ...	61/3	48/–	12½	12½	53/9	+¼	4 13 0
British Insulated Ord. ...	88/–	70/3	20	20	86/3	–¼	4 12 10
British Thermostat (5/–) ...	16/–	11/6	18½	18½	13/3	—	6 19 7
British Vacuum Cleaner (5/-)	22/6	8/–	40	12½	12/6	—	5 0 0
Brush Ord....	5/9	2/6	Nil	Nil	4/6	—	—
Callender's	92/–	50/–	20	15	66/3	–¼	4 10 8
Chloride Elec. Storage ...	82/–	62/–	20	15	3½	—	4 5 9
Consolidated Signal ...	96/–	60/–	36½	17	3½	—	5 4 7
Crabtree (10/–)	25/6	16/6	17½	17½	23/9	—	7 7 4
Crompton Parkinson :							
Ord. (5/–)	21/–	12/6	15	20	18/9	—	5 6 8
E. K. Cole (5/–)	9/–	2/6	10	Nil	3/6	—	—
Elec. & Musical Industries (10/–)	14/9	6/6	5	Nil	8/6	—	—
Electric Construction ...	40/6	28/–	12½	13½	35/–	—	7 14 4
Enfield Cable Ord. ...	58/–	37/6	25	16½	53/9	—	6 0 10
Electrical Switchgear (10/–)	27/–	23/–	16	10	21/3	—	4 14 3
English Electric	36/6	25/–	10	10	33/3	—	6 1 0
Ensign Lamps (5/–) ...	16/9	13/9	25	25	13/9	–¼	9 1 10
Ericsson Tel. (5/–) ...	43/–	32/3	25*	25*	36/3	—	3 9 0
Ever Ready (5/–)	26/6	16/9	35	30	27/–	—	5 11 1
Falk Stadelmann	27/–	18/–	10	6	17/6	—	6 17 4
Ferranti Pref.	25/6	21/–	7	7	23/9	—	5 18 0
G.E.C. :							
Pref.	32/9	25/–	6½	6½	32/–	–6d.	4 1 3
Ord.	82/–	61/–	17½	20	80/–	—	5 0 0
Greenwood & Batley ...	29/–	20/–	7	15	25/–	—	12 0 0
Hall Telephone (10/–) ...	22/3	7/–	15	15	18/3	—	8 4 4
Henley's (5/–)	21/–	13/9	20	20	20/9	—	4 18 1
4½% Pref.	23/–	18/–	4½	4½	21/3	—	4 4 8
Hopkinsons	46/9	37/–	12½	15	46/3	—	6 9 10
India-Rubber Pref. ...	22/–	17/9	5½	5½	20/9	—	5 6 0
Intl. Combustion	121/3	97/–	32½	32½	5½	—	5 10 6
J. Lucas	61/–	42/6	15	15	57/6	—	5 4 5
Johnson & Phillips ...	42/6	32/–	12½	12½	50/–	+1/9	5 0 0
Lancashire Dynamo ...	72/–	50/–	25	20	55/–	—	7 5 6
Laurence Scott (5/–) ...	12/–	8/6	15	15	11/–	+6d.	6 16 4
London Elec. Wire ...	31/6	25/–	12	7½	25/–	—	6 0 0
Mather & Platt	50/3	37/6	13½	10	40/9	—	4 18 1
Metropolitan Elec. Cable Pf.	21/3	21/–	5½	5½	21/3	—	5 3 6
Murex	85/9	63/9	20	20	81/3	—	4 18 6
Pye Deferred (5/–) ...	11/6	7/–	25	25	7/6	—	16 13 4
Revo (10/–)	35/6	22/–	17½	17½	20/–	—	8 15 0
Reyrolle	61/–	52/–	12½	12½	57/6	–¼	4 7 0
Siemens Ord.	26/9	17/–	7½	7½	23/9	—	6 6 4
Strand Elec. (5/–) ...	5/6	1/3	10	4	2/–	—	8 6 0
S. Smith (1/–)	9/6	5/6	37½	50	7/6	—	6 13 4
Switchgear & Cowans (5/–)	15/–	9/6	20	10	7/6	—	6 13 4
Telegraph Condenser (10/–)	7/6	5/–	5	—	8/9	—	—
Telegraph Construction ...	2½	27/6	10	10	36/3	—	5 10 4
Telephone Mfg. (5/–) ...	10/–	7/–	9	9	8/9	+3d.	5 2 10
Tube Investments... ...	91/6	68/–	23½	23½	92/6	—	5 4 6
Vactric (5/–)	4/3	2/–	4	Nil	3/3	+3d	—
Vickers (10/–)	24/6	14/6	10	10	18/3	—	5 9 7
Ward & Goldstone (5/–) ...	22/6	10/6	20	20	19/9	—	5 1 3
Westinghouse Brake ...	54/9	38/–	17½	10	43/9	—	4 11 5
Walsall Conduits (4/–) ...	31/9	21/3	55	55	26/3	—	8 7 8
West, Allen (5/–)	7/6	5/–	7½	10	6/6	—	7 13 10

* Dividends are paid free of Income Tax.

CONTRACT INFORMATION

Particulars of work for which tenders are invited, contracts placed, and building schemes promising work for electrical contractors and traders

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses. Further details of items marked with an asterisk can be obtained from the Department of Overseas Trade (Inquiry Room), Great George Street, London, S.W.1.

Australia. — MELBOURNE.—April 23rd. Posts and Telegraphs Department. Telephone testing equipment. (T. 16438/40.)*
April 16th. State Electricity Commission of Victoria. Electric lamps. (T. 17344/40.)*
Feed-water plant for the Newport "C" power station. (T.Y. 17684/40.)*
April 30th. Feed-water heating and evaporating plant, boiler feed pumps, pipework and accessories. (March 29th.)

Bath.—April 15th. City Council. Materials for one year. (March 29th.)

Belfast.—April 12th. Electricity Department. 120-kW mercury arc rectifier equipment. (March 29th.)

Birkenhead.—April 16th. Electricity Department. Stores for six months from July 1st, 1940. (See this issue.)

Birmingham. — May 10th. Electric Supply Department. Cable jointing compound for the year ending June 30th, 1941. (See this issue.)

Cardiff.—April 17th. Town Council. Two vertical-spindle electric motor-driven sewage pumps of the submerged open-impeller type, with all accessories, and each capable of delivering 18,000 gal. per hour, at the Llandaff North pumping station. Two similar type sewage pumps, each of 42,000 gal. per hour capacity, at the Mainly pumping station. G. H. Whitaker, City Hall.

Dudley.—Works Committee. Rewiring the Priory Hall. Town clerk.

Dundee.—April 10th. Electricity Department. Various works at the extensions to the generating station, Carolina Port. D. H. Bishop, general manager and engineer.

Edmonton.—April 8th. Corporation. Electrical installation at the central depôt, Montague Road, N.9. E. J. Willis, borough engineer, Town Hall.

Egypt.—ALEXANDRIA.—May 1st. Ports and Lighthouses Administration. Winch, with electric motor. (T. 16729/40.)*

Glasgow.—April 9th. Housing Department. Materials for maintenance and engineering work for twelve months, including electrical fittings and cables. Director of housing, 20, Trongate, Glasgow, C.1.
April 9th. Transport Department. Materials (annual contracts), including v.i.r. cable, electrodes, lamps, wire, &c. General manager, 46, Bath Street.

Eire.—MONAGHAN.—April 17th. Mental Hospital Committee. Electrical installation in the new hospital and nurses' home at the Mental Hospital. Nicholas O'Dwyer, 6, Burlington Road, Dublin (deposit £5 5s.).

Kirkcaldy.—April 8th. Electricity Department. Cooker control units for period ending May 15th, 1941. (March 29th.)

Kirkcudbright. — April 15th. County Council. Various works, including heating and domestic hot-water plant and electrical installation, in connection with the adaptation of mansion house as infectious diseases hospital. County Clerk.

London.—COMMISSIONERS OF H.M. WORKS.—April 26th. Installation of electric light and power services at H.M. Stationery Office, Harrow. (See this issue.)

Manchester.—April 10th. Electricity Committee. 11-V and 33-kV cable. (March 29th.)
April 19th. Kettles, meters, AC industrial motors and static transformers for one year. (See this issue.)

New Zealand. — WELLINGTON.—April 24th. General Post Office. Telephone parts, bell covers, &c. (T. 17170/40.)*
April 27th. Secondary cells. (T. 17177/40.)*

Nottinghamshire.—April 8th. County Council. Vehicle-actuated traffic control signals at Cossall Aqueduct, Awsworth-Ilkeston Road. County surveyor, Shire Hall.

South Africa.—JOHANNESBURG. — May 6th. Railway and Harbours Administration. Two 15-ton electric wharf cranes with 4-ton auxiliary hoists for Durban Harbour. (T. 17439/40.)*
Eleven 4-ton level luffing electric portal travelling wharf cranes. (T. 17640/40.)*
SALISBURY (SOUTHERN RHODESIA).—May 14th. Electricity Department. 11,000-V, 3,300-V and 460-V p.i. cables, v.i.r. cables and cable boxes, for the new power station, Western Commonage. (T. 17617/40.)*
CAPE TOWN.—May 15th. Electricity Department. Nine 10-kVA and six 25-kVA 3-phase pole mounting distribution transformers. (T. 17372/40.)*
DURBAN.—May 3rd. General Stores Department. Overhead line material and steel stay wire. (T. 17338/40.)*

Sheffield.—April 9th. Three electrically propelled refuse collection vehicles. Cleansing superintendent, Town Hall (deposit £1).

West Hartlepool.—April 11th. Electricity Department. H.V. and l.v. cables. (March 29th.)
April 20th. Borough Council. One 5,000 kVA three-phase transformer, 20,000/5,760 V. (See this issue.)

West Midlands.—April 26th. J.E.A. 11-kV distribution switchgear for Oakengates switching station, Shropshire distribution area. (See this issue.)

Wimbledon.—April 8th. Corporation. Paper-insulated cables. (March 29th.)

Orders Placed

Belfast.—Electricity Committee. Accepted. Carbon dioxide fire extinguishing equipment for substations (£465).—Walter Kidde Co. Condenser tubes (£1,693).—I.C.I. Metals. Fire hydrants for the Harbour power station.—Pyrene Co. 500-kW mercury arc rectifier equipments (£32,949).—Hewittic Electric Co. 6.6-kV armour-clad switchgear and cabling for the Harbour station (£2,178).—A. Reyrolle & Co.

Darlington.—Town Council. Accepted. Eight trolley-bus bodies.—East Lancashire Coachbuilders, Ltd. (£5,472). Chassis.—Transport Vehicles (Daimler), Ltd. (£2,578 for two) and Karrier, Ltd. (£2,576 for two).

Glasgow. — Streets Committee. Accepted. Alteration to electric passenger lift at St. Enoch House, Argyle Street (£163).—Waygood-Otis.

London. — BATTERSEA. — Electricity Committee. Recommended. Supplies for twelve months: Meters.—Chamberlain & Hookham; Ferranti. Joint boxes and house service cut-outs.—Callender's. Disconnecting boxes, copper wire and insu-

(Continued on next page.)

Financial Section (*Concluded from page 412*)

Reports and Dividends—contd.

A circular to shareholders states that it is proposed to issue 6 per cent. unsecured notes to the extent of £50,000. New money is required to finance existing favourable trading opportunities.

British Industrial Plastics, Ltd., is to approach the Treasury for permission to issue a portion of the additional capital that was authorised at the annual meeting in 1937, in order to meet the growing demand for the company's products both for home and export. Subject to permission being granted, shareholders will be given the opportunity to subscribe for additional shares.

The Isle of Thanet Electric Supply Co., Ltd., reports a profit on working for 1939 of £45,005, which with £1,288 interest and £3,449 brought forward makes £49,743. From this is deducted £10,978 applicable to sinking funds "A" and "B" for redemption of capital expenditure on electricity supply, leaving a balance of £38,765. Debenture stock service fund absorbs £15,000, and interest on sinking funds "A" and "B" £818. The ordinary dividend for the year is 2 per cent., less tax, and £3,027 is carried forward. Debenture stock of a nominal value of £5,756 was redeemed and cancelled during the year, and the resulting credit of £5,804 arising has been applied in further reduction of a deficiency on the transport undertaking. On account of the reduced consumption of electricity and increasing costs arising from the war, increased charges were introduced from the commencement of the current year.

The Radio Corporation of America reports a gross income for 1939 of $110,494,398, as compared with $99,968,110 for 1938, and a net profit of $8,082,810 (against $7,412,072). The dividend on the first preferred requires $3,152,895, on the "B" preferred $68,321, and on the common shares $2,770,791. The balance carried forward is $20,531,335 (against $19,061,504 brought in).

The British Oxygen Co., Ltd., is making a bonus issue of ordinary shares in the proportion of £1 to every £5 of stock held, and it proposes to capitalise £576,850 of the reserve for this purpose. The bonus issue is recommended in order to bring the nominal amount of the issued ordinary capital into closer relationship with the value of the assets. The consolidated gross profit for 1939 is £1,387,995, an increase over the preceding year of £187,595, and the available profit of the parent company is £528,388, an increase of £20,329. The total ordinary dividend is again 17 per cent., less tax. It is proposed to place £61,850 to reserve, which with £65,000 capital profits available this year on the reorganisation of certain subsidiaries, brings it up to £676,850. After deducting the proposed capital bonus the reserve will stand at £100,000. It is also proposed to place £100,000 to tax reserve. The balance carried forward is £40,258.

The Ascot District Gas & Electricity Co., Ltd., reports a net revenue for 1939 of £18,447. The ordinary dividend for the year is 5 per cent., less tax, and £4,606 is carried forward.

The Windermere & District Electricity Supply Co., Ltd., reports a profit for 1939 of £8,237 which, with £5,204 brought in, makes £13,441 available. Reserve receives £3,000, and it is proposed to pay a final ordinary dividend of 6 per cent., making 10 per cent. and leaving £5,271 to be carried forward.

The Rangoon Electric Tramway & Supply Co., Ltd., reports a gross profit for 1939 of £172,403, as compared with £194,924 in 1938, and a net profit of £53,949 (against £73,337). The final ordinary dividend is 12 annas, making R.1 free of Burma tax (against R.1 6 annas), and £18,068 is carried forward (against £20,297 brought in).

The Cornwall Electric Power Co. is paying a first and final dividend of 3 per cent. (against 4 per cent.).

The Urban Electric Supply Co., Ltd., has announced a final dividend of 4 per cent., again making 8 per cent.

The South Wales Electric Power Co. is paying a final dividend of 3½ per cent., maintaining the distribution for the year at 5½ per cent.

The Wessex Electricity Co. proposes to pay a final ordinary dividend of 3 per cent., making 4½ per cent. for the year.

The North Somerset Electric Supply Co., Ltd., is paying a first and final dividend of 7 per cent. (same).

The Shropshire, Worcestershire and Staffordshire Electric Power Co. has announced a final dividend on the "A" ordinary of 4 per cent., making 8 per cent. for the year (same), and on the "B" ordinary 3 per cent., making 5½ per cent. (unchanged).

lating tape.—Henley's. Joint box compound.—Dussek Bitumen and Taroleum. Electrical wires for installation work.—Stearn Electric Co. Flexible wires and wiring accessories.—W. White & Co. Steel sheathing and fixing clips.—Wholesale Electric Co. Conduit and conduit fittings.—Sloan Electrical Co. Switches and cooker control units.—J. A. Crabtree & Co. Ironclad cut-outs and switch fuses, ironclad splitters.—Foster Engineering Co. Cookers.—Jackson Electric Stove Co. Cookerettes.—Belling & Co. Water heaters. — Heatrae. Immersion heaters.—Santon. Wash boilers.—Alder Electrical Appliances. Irons.—Revo Electric Co. Kettles.—Bulpitt & Sonse. Glassware.—Falk, Stadelmann & Co. Switchplugs.—T.M.C.-Harwell (Sales), Ltd.

BERMONDSEY.—Electricity Committee. Accepted. 2,000-A switch (£90). Whipp & Bourne. "Meg" insulation tester (£20). Evershed & Vignoles. Two distribution pillars (£145).—Henley's.

Manchester. — Electricity Committee. Accepted. Neutral earthing equipments and resistor.—Ferguson, Pailin. Conversion of passenger lifts.—Waygood-Otis. Emergency street lighting fittings.—Wardle Engineering Co.; Ferranti; B.T.H. Co.

Health Committee. Accepted. Electric service lift at Withington Institution.—Etchells, Congdon & Muir.

Morecambe.—Sewage Committee. Accepted. Revised tender for pumping plant for sewage works (£19,843). W. H. Allen & Sons.

Newcastle-on-Tyne.—City C ·il. Accepted. Electrical repairs to ouncil houses during the coming six months (£180).—Graham Berrie.

Sheffield. — Electricity Committee. Accepted. Switchgear for Stanley Street substation (£8,615).—Met.-Vick. Elecl. Co. Cables for twelve months.—W. T. Glover & Co. Contracts extended for a further twelve months: Static transformers.—Electric Construction Co.; Hackbridge Electric Construction Co.; G.E.C.; Bonar Long & Co. Distribution switchgear.—A. Reyrolle & Co.; Met.-Vick. Elecl. Co.; Crompton Parkinson.

Sewerage Committee. Accepted. Two sets of reduction gears for bio-aeration plant at Blackburn Meadows (£728).—Turbines, Ltd.

Education Committee. Accepted. Electrical installations at Fulwood and Woodhouse schools (£308).—W. Malthouse.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Acton.—Extensions to factory for Acton Bolt & Fine Threads, Ltd., 26, Chase Road.

Extensions to factory, Brunel Road; H. G. Huckle, architect, 19, Wrottesley Road, Harlesden.

Banstead.—Fire station (£20,859), Chipstead Valley Road, for U.D.C.; William A. Pite, Son and Fairweather, architects, 12, Carteret Street, Queen Anne's Gate, London, S.W.1.

Berwick.—A.F.S. stations at Wallace Green and Tweedmouth, for the T.C.; borough engineer.

Birmingham.—Castle Cinema, Bradford Road, Castle Bromwich; H. Dare & Son, builders, Ward End, Birmingham.

Parade of shops and flats on Stratford Road, Shirley; Healey & Baker, architects, New Street, Birmingham.

Blackburn.—Senior school, for St. Albans R.C. school managers.

Blackpool.—Offices and warehouse, near Kingsley Grove; F. H. Vickers, 12, Thirsk Grove.

Brighouse.—Alterations to ground floor of Mill House for electricity showrooms; H. A. Sneezum, borough surveyor.

Bromsgrove.—Cleansing depôts, Church Street and Heath Lane, Rubery, for U.D.C.; surveyor, Council Offices.

Carlisle.—Technical college for the E.C.; P. Dalton, city engineer, 18, Fisher Street, Carlisle.

Cheshire.—Schools, Chester, Stockport and Northwich, for Diocesan Church Schools Association; F. C. Saxon, architect, 2, Stanley Street, Chester.

Clay Cross.—Clay Cross Hippodrome, Ltd., Cavendish House, Cavendish Street, Chesterfield, are proposing the rebuilding of the Hippodrome at Clay Cross; Harry Middleton, secretary and director of the Clay Cross Hippodrome, Ltd.

Coventry.—Bus depôt, Canley (£50,000); city engineer.

Rebuilding the "Red House" Hotel, Stoney Stanton Road, for Ansells Brewery, Aston, Birmingham; H. Clarke & Sons, builders, Coventry.

Darlington.—Additions to warehouse, Maude Street, for J. C. and N. Murray.

Air-raid shelters for the E.C. at the Guerney Pease and Rise Carr schools; borough engineer.

Depwade.—Houses (51), on various sites, for R.D.C.; surveyor, Council Offices, Pulham Market, Norwich.

Derby.—Rebuilding of Chesterfield Grammar School; county architect, County Offices, St. Mary's Gate, Derby.

East Lothian.—Completion of housing schemes at Mid Road, Prestonpans, and Muirpark Terrace, Tranent, for Public Health Committee; county architect, County Buildings, Haddington.

Epsom and Ewell.—Public shelters (£5,962), for T.C.; borough engineer, Town Hall, The Parade, Epsom.

Finchley.—Flats, Prospect Place; Fairways, Ltd., 102, West Ferry Road, E.14.

Offices and workshops, High Road; Carrimore Six Wheelers, Ltd., Great North Road, N.12.

Glasgow.—Completion of 248 houses, Barrowfield estate; housing director.

Motor showrooms, Argyle Street; Eric R. Dawson.

Gloucester.—Operating theatre block and adaptation of boiler house, &c., City General Hospital, Great Western Road; city architect, Suffolk House, Gloucester.

Guisborough.—Extensions to factory for Blackett, Hutton & Co., Ltd., Providence Street.

Hemsworth. — Fire and ambulance station, and hose and drill tower, South Kirby, for R.D.C.; S. Price, surveyor, Market Chambers, Hemsworth, near Pontefract.

Hendon.—Extensions to works; Tilley Bros., Brent Street.

Hinckley.—Factory extensions, Brookfield Road; Burgess Products Co., Ltd.

Factory additions, off Coventry Road, Burbage; Burbage Hosiery Co.

Ilford.—Extensions to fire brigade headquarters, Ley Street, for T.C.; L. E. J. Reynolds, borough engineer, Town Hall, Ilford.

Jarrow.—Conversion of premises in Tyne Street into A.F.S. station, and shelters at Dunn Street School, for the E.C.; J. S. Weir, borough engineer.

Extensions, including new plant, at works of Jarrow Metal Industries, Ltd.; W. Scott, director and engineer.

Lancashire.—Stretford technical college (£11,319), with equipment (£11,688), for E.C.; county architect, county offices, Preston.

Lancaster.—Additions to works, Monmouth Street and Plum Street, for Storey Bros. & Co., Ltd.; E. Middleton, architect, 46, King Street, Lancaster.

Leeds.—Temporary school accommodation, Seacroft Grange, for E.C.; G. Guest, director of education, Education Offices, Leeds, 1.

London.—FULHAM.—Public and communal shelters, Branksea Street, Delaford Street, Caroline Walk, Beryl Road, Bishop's Park, and North Sheen cemetery, for Civil Defence Emergency Committee; borough engineer.

BETHNAL GREEN.—Working class accommodation, for Sutton Dwellings Trust, Victoria House, Southampton Row, London, W.C.1.

Manchester.—Houses at Wythenshawe and flats at Gorton and Miles Platting, for the T.C.

Additions to works for packing case store and electricity substation, Chatham Street, Clayton, for Clayton Aniline Co., Ltd., Clayton.

Mansfield.—Store, Kings Mill Avenue; J. C. Frame, Ltd.

Morpeth (NORTHUMBEERLAND).—Rebuilding of the Turks Head Hotel; R. Carse & Son, contractors, Oldgate, Morpeth.

Newcastle-on-Tyne.— Further air-raid shelters (£13,000); director of education. Air-raid shelter, Northumberland Road, for juvenile employment bureau (£600); city architect.

Nocton (LINCS).—Factory, for Lincolnshire Flax Co., Ltd., Metheringham Heath Farm; Percy V. Burnett, architect, 107, Jermyn Street, St. James, London, S.W.1.

Norwich.—Completion of new Earlham school, for E.C.; borough engineer.

Nottinghamshire.—Alterations to the laundry at Kilton Hill County Hospital, Worksop; E. W. Roberts, county architect, Nottingham.

Oswaldtwistle.—Extensions, chemical works, Nook Lane; Dickinson & Son.

Alterations, Vine Mill; Vine Spinning Co., Ltd.

Paignton. — Additions to Coverdale Hotel; Tamar Brewery, Plymouth.

Rocester.—Extensions to the Abbotsholme School, for the board of governors; Ward and Godbehere, building contractors, Smithfield Road, Uttoxeter.

Rochdale.—Alterations to the Wellington Hotel, Drake Street and Smith Street, for Higson's Brewery Co., Ltd., 117, Dale Street, Liverpool (£20,000); H. H. Clough, architect, Old Market Chambers, Rochdale.

Romsey. — Completion of housing scheme, Alma Road (£3,359), for T.C.; borough engineer, Town Hall.

Sheffield.—Rebuilding Black Horse licensed premises, Upper Allen Street, and new public house, Herries Road; Tennant Bros., Ltd.

Shops and houses, Carterknowle Road; G. Handley.

Kitchens and stores, Jessop Hospital for Women, Brookhill; governors.

Rolling mill, Neepsend Lane; Andrews Toledo, Ltd.

Factory, Arundel Street; M. M. Bell & Sons.

Shrewsbury.—New valve chamber, Coleham pumping station, for T.C.; borough engineer.

Somerset.—Reconstruction of county and divisional police headquarters, Taunton, for Standing Joint Committee; R. O. Harris, county architect, Park Street, Taunton.

Spilsby.—Houses at the Causeway; R.D.C. surveyor.

South Shields. — Reconstruction of Station Hotel, Mile End Road, for R. Deuchar & Co., Ltd. (£5,000); George Henderson, Boldon Lane, East Boldon, Durham.

Stannington (NORTHUMBERLAND). — Emergency hospital; R. Carse & Son, contractors, Oldgate, Morpeth.

Stockton-on-Tees. — Alterations to works, for Stockton Chemical Engineers and Riley Bros., Ltd., Perseverance Works.

Fire stations, Elmwood and West Row, for T.C.; borough engineer, Town Hall.

Street.—Extensions to factory, for Avalon Leather Board Co.

Sunderland.—Alterations and improvements to the Mountain Daisy Hotel; Randle & Co., Back Dunedin Street, Sunderland.

Tamworth. — Extensions, off George Street, for Bole Hall Mill Co., Ltd., Marston and Linford, architects, Market Street.

Tottenham. — Factory extensions, Southey Road; L. S. Mayer, Ltd.

Tynemouth.—House and shop, River View, for Mr. Legg; G. H. Gray, architect, 50, Camden Street, North Shields.

Alterations to the Ridges Inn, Waterville Road, for McEwan and Co., Ltd.; Page, Son and Bradbury, architects, 75, King Street, South Shields.

Ulverston.—Fire station, for U.D.C.; surveyor, Council Offices.

Urmston.—Extensions to works building, Tenax Road, Trafford Park, for the Trafford Park Steel Warehouses, Ltd.

Warrington.—Building department and offices, Gee Street and Dannett Street; P. Walker and Sons, Ltd.

Wetherby.—Fire station, site adjoining Council Offices, for R.D.C.; G. A. Burnett, surveyor, 76, Albion Street, Leeds.

Widdrington (NORTHUMBERLAND). — Houses; T. Watson, architect, Rural Council Offices, Morpeth.

York.—Additions to Victoria Bar Chapel, Victor Street; Oliver & Sons, Ltd.

Additions to Lion and Lamb Hotel, Blossom Street; J. Tetley & Sons, Ltd.

Additions, cake department, Haxby Road; Rowntree & Co., Ltd.

Additions to Baptist Church, Priory Street; Trustees.